BACS®

User Manual
BACS® Battery Analysis & Care System

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General Safety Precautions - Working with Batteries

Improper use of the products described in this manual may lead to personal injury and/or property damage. GENEREX is not liable for injuries or damages that result from improper handling these products.

Risks associated with improper use include: explosion, fire, and short circuits. **Attention!** Battery terminals are always live, so never place metal objects or tools on top of the batteries.

Battery electrolyte solutions are highly corrosive. Should you observe leaks of electrolyte from a battery, be aware that these fluids are harmful to both eyes and skin.

Installation, maintenance, and repair of batteries and battery equipment should be performed only by trained specialists (or personnel authorized by battery manufacturers to perform such services). Persons who have not been trained in battery safety or the proper handling of batteries (or who have not been authorized to work on them) must not handle batteries.

Observe the following regulations (IEEE standards USA only):

- ZVEI publication "Instructions for the Safe Handling of Electrolyte for Lead-acid Accumulators."
- ZVEI publication "Safety Data Sheet on Accumulator Acid (Diluted Sulfuric Acid)."
- VDE 0510 Part 2: 2001-12, in accordance with EN 50272-2:2001: "Safety Requirements for Secondary Batteries and Battery Installations - Part 2: Stationary Batteries".
- IEEE Standard 450-2002: "Recommended Practice for Maintenance, Testing and Replacement of Vented Lead Acid Batteries for Stationary Application."
- IEEE Standard 1375-1998: "Guide for Protection of Stationary Battery Systems"

Observe also the following safety rules:

1. **Ensure that all electrical loads and power supplies/charging devices (including separators, fuses, and switches) are switched off. This must be carried out by qualified personnel.**
2. Remove all wrist watches, rings, chains, jewelry and other metal objects before working with batteries.
3. Use insulated tools only.
4. Wear insulating rubber gloves and rubber shoes.
5. Never place tools or metal components on top of the batteries.
6. Make sure that the battery or batteries are not mistakenly grounded. (The consequences of an accidental or incorrect connection can be mitigated reduced by terminating the ground connection.) If the system is grounded, terminate the connection. **Touching a grounded battery by mistake can result in severe electric shock.**
7. Before establishing connections, make sure to verify polarity. (Better one too many times than one too few.)
8. Filled lead-acid batteries contain highly explosive gas (hydrogen/air mixture). **Never smoke, handle open flames or create sparks near the batteries.** Always avoid electrostatic discharge; wear cotton clothing and ground yourself if necessary.
9. Wear the appropriate safety clothing and equipment.

For further information refer to the battery makers instructions for installation, maintenance, and operation of their battery products.

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Safety – BACS® Safety Precautions

⚠	⚠ ATTENTION	
	HIGH VOLTAGE WARNING	Do not open the BACS® sensor modules. Do not attach any kind of objects to the battery or the BACS® modules itself apart from the connecting cables! **The BACS® modules and cables could be live!**
	MAGNETIC EMISSIONS	Do not put any materials or equipment sensitive to magnetic emissions near the BACS® WEBMANAGER (For example, monitors, disk drives, memory chips or magnetic tapes.)
	INSTALLATION BY QUALIFIED PERSONNEL ONLY!	The BACS® installation should only be installed by qualified personnel. BACS® is installed on batteries where high voltages could cause injuries or even death if not handled properly!
	WARNING!	The BACS® connection cables (temperature cable, bus cable, measuring cable) could be live! To avoid short circuits, do not touch, replace, or cut BACS® cables, before having disconnected the system from the batteries! BACS® modules must NOT be mounted on a damaged battery! If a battery is damaged and its internal resistance is high, charging current (or current being discharged) may follow the path of least resistance and flow through the BACS® module, not the battery. Overheating and destruction of the BACS® module can result from this**.** For this reason, never use batteries that are damaged or show high internal resistances.
	CHECK MODULES DURING INSTALLATION AND INITIAL CHARGING	The GENEREX service technician should monitor the BACS® modules and the initial charge during the installation. Excessive heat created by the BACS® may be indication of a damaged battery or incorrectly mounted cables. The installer should not leave the installation site before installation of the BACS® system is complete and the battery has had 60 minutes to charge. Once this has taken place, if the BACS® system shows stable voltages and normal internal resistance values, it may be considered safe and can be monitored remotely.
	Observe battery temperature for up to 12 hours after a discharge period	Observe battery temperature for up to 12 hours after a discharge period! For VRLA batteries, the risk of thermal run-aways is greatly elevated during the 12 hours following discharge. Rising temperatures in damaged battery cells and blocs can cause fire. React immediately if battery cell or bloc temperatures rise after a discharge phase.

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Safety – BACS® Configuration and Installation

⚠ AVOID INSTALLATIONS IN CERTAIN AREAS

Do <u>not</u> install BACS® in the following areas:

- Wet or dusty places, or rooms that are not protected from water or high humidity;
- Areas with a constantly high concentration of salted or oxidizing gases;
- Areas close to sources of extreme heat, open flames, or sparks, or having high variations in temperature;
- Areas prone to physical vibrations.
- Areas with high gas concentration or flammable materials.

⚠ MONITORING SYSTEM - MONITORING AND ALARMS

BACS® is a monitoring system and should be used accordingly. Ensure proper setting of the alarm threshold and proper time frame for reaction to alarms!

- BACS® is a tool designed to increase the durability of accumulators, but its most important function is to monitor the battery in order to avoid breakdowns. For this reason, it is recommended that situations that trigger alarms be attended to within two hours of alarm notification. BACS® may not be able to eliminate altogether the risk of battery or charger failures, but through its advance warning system and patented Equalization process, it gives the user the ability to prevent the issues that can result from such failures.
- **Never mix and match different BACS® C Module versions or BACS® Measuring cable types!** (For example: using BACS® C Modules with REV 2 and 3 on the same battery system, using BACS® BC2 and BC5 cables in the same battery system.) This practice can damage modules and lead to inaccurate measurements.

For questions and comments refer to: www.generex.de or support@generex.de

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User Manual BACS WEBMANAGER

GERMAN Version : Dieses Handbuch ist auch in Deutsch verfügbar!
Eine aktuelle Kopie erhalten Sie unter download bei www.generex.de.

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Battery Management with BACS®

General Information
The BACS „**B**attery **A**nalysis & **C**are **S**ystem" now the 2nd generation is the most advanced product on the market today providing an Ethernet-network integrated battery monitoring and management system. Using web-management technology it checks the internal resistance, the temperature and the voltage of every single accumulator cyclical. Through a voltage Equalisation process it corrects and manages the charging voltage of each accumulator and additionally manages environmental values (temperature, humidity, concentration of hydrogen gas etc.) and other Power devices (UPS, inverters, rectifiers etc.)
The accumulators are kept in the optimal Voltage operating range. The continuous monitoring and limitation of the single charging voltage of each battery causes a guaranteed availability of the batteries at anytime.
BACS is the ideal system for all lead based batteries (open/wet, maintenance free, gel, AGM), etc.

Figure 1: Diagram of a typical BACS system setup

The BACS system is designed for the individual monitoring and control of each of the accumulator in the battery system and regulates the voltage symmetry during the charging process and providing warnings in case of asymmetric discharging or other failures.

The BACS system provides charging control for each accumulator, the voltage from the charging device/UPS will be distributed evenly to all accumulators through the patented **GENEREX BACS-Equalisation process**. The result is a homogeneously voltage on all batteries in the system thereby an increasing the service life and capacity of the total battery system.
It stops the overcharge of single accumulators and warns in case accumulators go into deep discharge. The damage of weak accumulators through overcharge or unnoticed deep discharging is now watched.
Problems of sulphation because of not fully charged batteries in standby, is minimized through a constant trickle charge through BACS Equalisation process. Because the BACS system detects such problems the user is able to start counteractive actions before the accumulator reaches a damaged and non recoverable position. (e. g. by a controlled discharging process the sulphation may be removed). Complex and costly manual monitoring and maintenance work are with BACS no longer necessary. The total battery data of every single accumulator is now available at any time through the network.

Should the BACS-Equalisation repair process not be able to overcome the voltage level of a problem accumulator then the replacement of this single accumulatorn should take place, before it interferes with nearby accumulators. The single accumulator with performance impacting the entire battery system belongs in the past. The accumulator can be managed at any time and for the accumulator to reach the life span as declared by the battery manufacturer.

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BACS secures the availability of the battery system and the optimum of capacity through the constant monitoring of the accumulators and builts the basis for the decision to extend the lifespan of this battery system. Out of our experience with BACS since 2004 we can detect that the common durability of accumulators into UPS devices can be duplicated ! The « lifespan » of a single accumulator is defined by the specificadtion of the accumulator manufacturer, e.g. 10 years. But the « durability » in a UPS system is just about 50% of this lifespan. At UPS devices, the accumulators got a higher negative mutual interference, this effect is higher the more formed into a group. Therefore the lifespan is reduced to what is called « durability », about 50% of the lifespan. In an ideal situation BACS allows the usage of such UPS accumulators up to the « lifespan » specified by the accumulator manufacturer.

BACS provides the most economic monitoring for every single accumulator within the battery system with extensive analysis of the battery data. BACS is available for small (7 Ah) and big stationary lead batteries up to 6000 Ah – in 4 versions (2V, 4V, 6V, 12V).

The BACS system has an actual alarm threshold system and a database for battery history. The system reads and stores the individual battery values for internal resistance, temperature and voltage. If the optional BACS_CS current sensor is attached then, also the DC currents at charge and discharge will be stored for analysis. The data is transmitted via the bus-system to the **BACS WEBMANAGER**.
The BACS WEBMANAGER is the central control unit for the system, where all information will be interpreted and stored. A display or Alarm LED and buzzer informs about the actual status of the accumulators. It provides the web-interface for the comfortable configuration and display of all system values.
The BACS Webmanager calculates constantly the reference value of the charging voltage, which every battery should have the correct overall voltage. If any accumulator deviates from the average charging voltage the BACS WEBMANAGER sends a correction command to on this specific BACS module to manage this accumulator. This individual charging/discharging of accumulators is our patented “Equalisation” process.

The values for the internal resistance, the voltage, the temperature, the delimiter of the activity and the amount of the charging- and discharging processes will be collected and monitored through the BACS WEBMANAGER. Accordant alarms will be routed via the network or (optional) modem, email, SMS, SNMP or RCCMD. The alarm system provides an audible sound via a local buzzer and an Alarm LED plus dry contacts for external interfaces. Alarms are also readable in the MODBUS format at one of the serial interfaces and/or over MODBUS over IP.

The BACS WEBMANAGER has an internal Flash-ROM of at least 32MB (BUDGET version), which is able to store all battery data up to 3 years (depending on number of accumulator, alarms and battery discharges) due to optimized storage routines. All data stored on the BACS WEBMANAGER can be downloaded and archived via the network.

Alarms at the battery or other devices, which are connected to the UPS, will be logged with date and time. The BACS WEBMANAGER is provided with an automatic synchronization to a timeserver in the network, to report all data and alarms in a chronological file for log reporting.

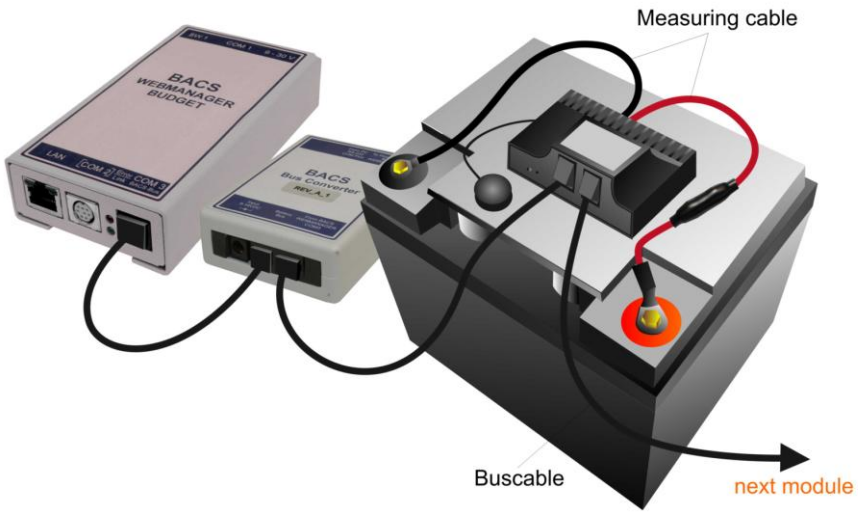

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Figure 2: BACS WEBMANAGER BUDGET typical setup

BACS® Components

BACS Battery C-Modules

The control of the charging and discharging activity of each accumulator during the Equalisation process and the measuring of the actual state of the accumulator is transmitted through the BACS C-modules, which are mounted on every accumulator. The accordant C-module for your battery system is depending on the battery type (Voltage) and its dimensions. Take a look into the actual BACS Datasheet for the key data of the available C-modules.

Figure 3: BACS C20 REV 1.4/2.2 Module – BACS C20 REV 3 Module

NOTE: BACS C20 modules from Rev. 2.1 and BACS C41/42 modules from Rev. 1.1: *Theses BACS modules have an improved ECO mode and will automatically switch off to save energy if no communication is present. . After 4 seconds of bus activity (e.g. through BACS Programmer or BACS Webmanager polling) all modules will "wake up" and are ready for the programming or rather normal operation*

BACS Measuring Cables

This is the cable for measuring the voltage and impedance of the connected accumulator. It's a 4 wire cable with 2 fuses in the positive cable (red) to protect the BACS system against high currents or short circuits. This cable has to be firmly fixed on the accumulator terminal and should be installed, before the BACS modules are connected.

BACS Bus Cables

The BACS bus –cables is the highway communication bus between all BACS modules in a battery system. This cable is specially shielded against EMI and is calibrated to guarantee a safe communication also in rough environments. The cable length should be optimized, the shorter the cable the less risk to have problems due to EMI.

BACS WEBMANAGER Kit

The BACS WEBMANAGER BUDGET is the central controller unit of the battery system and communicates with all the accumulators via the BACS bus. The BACS WEBMANAGER Kit consists of the BACS CONVERTER, the BACS WEBMANAGER itself and several spare cables and power supplies. The BACS WEBMANAGER has to be connected to the BACS communication cables to start the configuration and monitoring process.

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Figure 4: BACS WEBMANAGER BUDGET external kit (left), slot version kit (right), with spare cables

Figure 5: BACS WEBMANAGER BUDGET II with integrated BACS CONVERTER

Any BACS WEBMANAGER system includes a fully qualified SNMP / Web UPS manager at COM 1. Additionally any BACS WEBMANAGER system offers as options several sensors for DC current, (BACS_CS), room temperature and humidity (SM_T_COM or SM_T_H_COM), plus other environmental and customized sensors (SENSORMANAGER). Also available is a management software for managing multiple remote BACS monitoring sites. The UNMS “UPS Network Management System” provides this service and is available and for automatic messaging and shutdown of computers via the module RCCMD – “remote console command”. The full product portfolio from Generex with all optional modules is shown in the figure below.

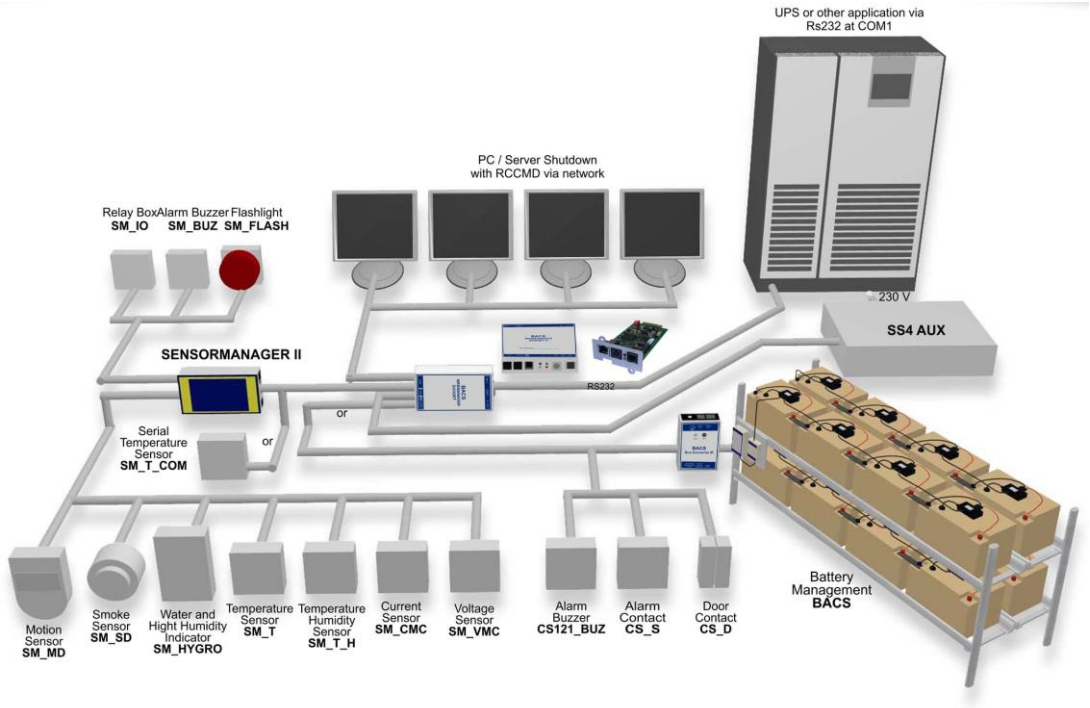

Figure 6: Overview of optional modules for a BACS system

BACS RAS WEBMANAGER Budget

The BACS RAS (Remote Access Server) WEBMANAGER BUDGET provides the remote monitoring of systems, which got no network connection at site or require a connection via telephone. Please take a look into the RAS Manager user manual for further information. The BACS RAS Webmanager requires an external BACS BUS CONVERTER III!

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Figure 7: BACS RAS WEBMANAGER BUDGET II with integrated modem

1. Quickstart - Installation of the BACS Hardware

The installation of BACS consists of 4 major steps, each of these steps are described as "Quickstart" in the chapters 1 to 4. Please take a look into the BACS user manual und BACS Viewer manual for further information.

1.1 Installation of BACS Cables, Module, Converter & Splittbox

1.1.1 Assemble the BACS Measuring Cable

Assemble the supply- and measuring cables (Part No. *BC2MCxxx*) to the battery terminals. Please note the right polarity, red cable at the plus terminal (+), black cable at the minus terminal (-). Please tighten the terminal and monitoring screws with the torque as denoted by the manufacturer.

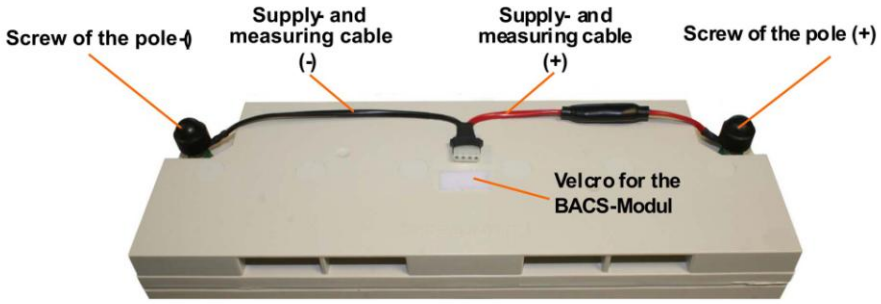

Figure 8: Typical assembling of a BACS Measuring Cable

1.1.2 Connect the BACS Measuring Cables to the BACS C Modules

After installing the BACS measuring cables, connect the 4 Pole connector with the BACS modules. Insert the connector until you can feel that the lock is closed. Remove the velcro from the module and detach the foil (most suitable is a cutter, look at the picture further down). Contact the velcro under high pressure on a suitable place of the batterie, see picture below. The contact pressure is important for an optimal contact. At REV 3, 2 foils have to be removed. The smaller one is for the integrated temperature sensor into the housing, which should be in contact with the surface of the accumulator. Take note, that the surface is clean to ensure a proper fixing of the sensors to the surface. For the degreasing/cleaning we recommend to use only solvents, which are recommended by the battery manufacturer. If you are unsure, then simply use soapy water and clean and dry the surface carefully.

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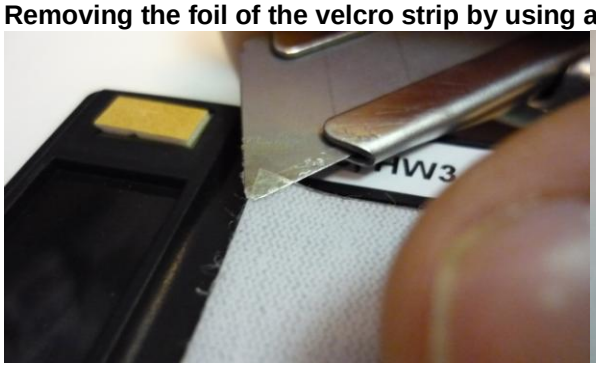
Removing the foil of the velcro strip by using a cutter:



Removin the foil of the temperature sensor by using a cutter:

Bonding of the velcro on the battery:

Optional REV 3 : You can order an external temperature sensor for the REV 3. This one will be mounted as the REV 2 as follows.

REV 2 : This type of C Module hat its temperature sensor on a 10cm cable which has to be placed on the battery surface. Detach the foil at the temperature sensor and place the sensor nearby the housing of the accumulator (not on cooling fins nor closing plugs). Please note, that the surface is clean to assure an accurate attachment of the sensor.

Note: Do not mix install different BACS C module versions on the BACS bus. E.g. you cannot use BACS C REV 1.3 together with BACS C REV 2.2 in the same system, the BACS bus will refuse to start working unless all C modules are same hardware revisions.

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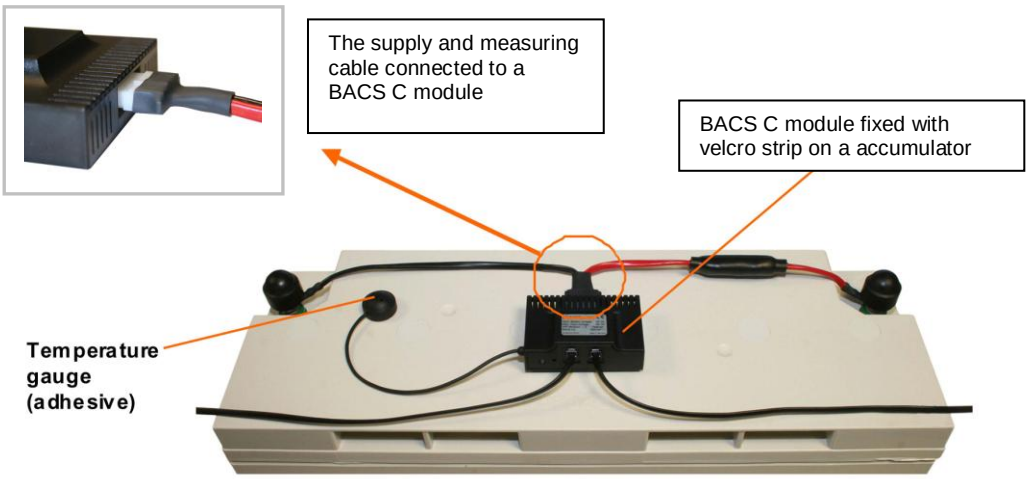
The supply and measuring cable connected to a BACS C module
BACS C module fixed with velcro strip on a accumulator
Temperature gauge (adhesive)

Figure 9: Assembling and Connection of the Module

All modules should be connected together via the RJ10 bus-cables (Part No. *B2BCRJ10xxx*) using the 2 sockets at the back of the BACS module. Using the bus-cables connect all the modules in series (any socket of the BACS module can be used, it does not matter if left or right socket). The last cable has to be connected to the BACS BUS CONVERTER or to the BACS WEBMANAGER Input.

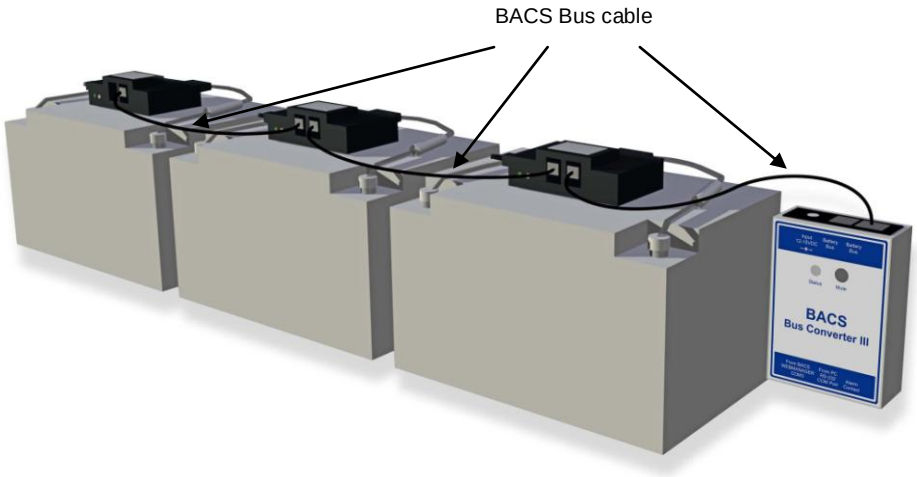

Figure 10: BACS bus cables (Part No. B2BCRJ10xx) connected to a BACS CONVERTER

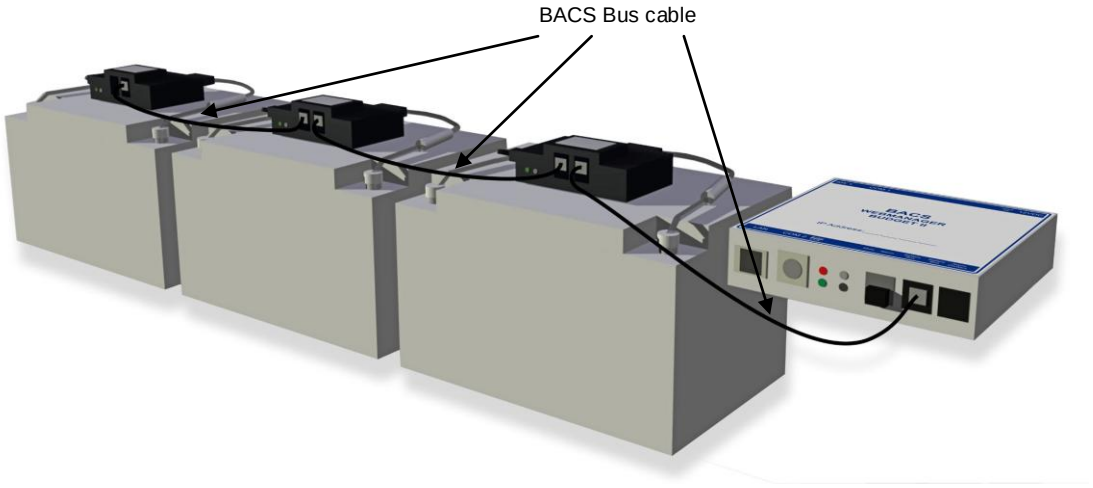

Figure 11: BACS bus cables connected to a BACS WEBMANAGER BUDGET II internal CONVERTER

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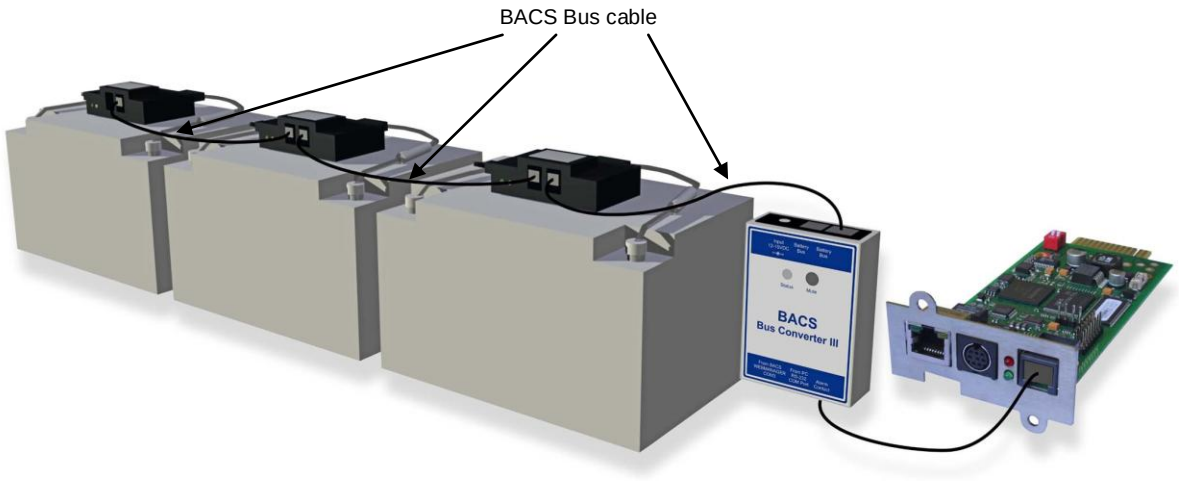

Figure 12: BACS bus cables connected to a BACS WEBMANAGER BUDGET Slot version - For usage with UPS, Inverters, Rectifiers, Chargers or other devices with such a compatible slot type

For battery systems with more than 50 batteries, we recommend the usage of a **BACS Splitting Box** (Part. No. BCII_SPLITT). A SPLITTINGBOX is for avoiding extreme bus cable length and allows the installation engineer to optimize the bus cable route for tidy installation.

Figure 13: BACS SPLITTING BOX

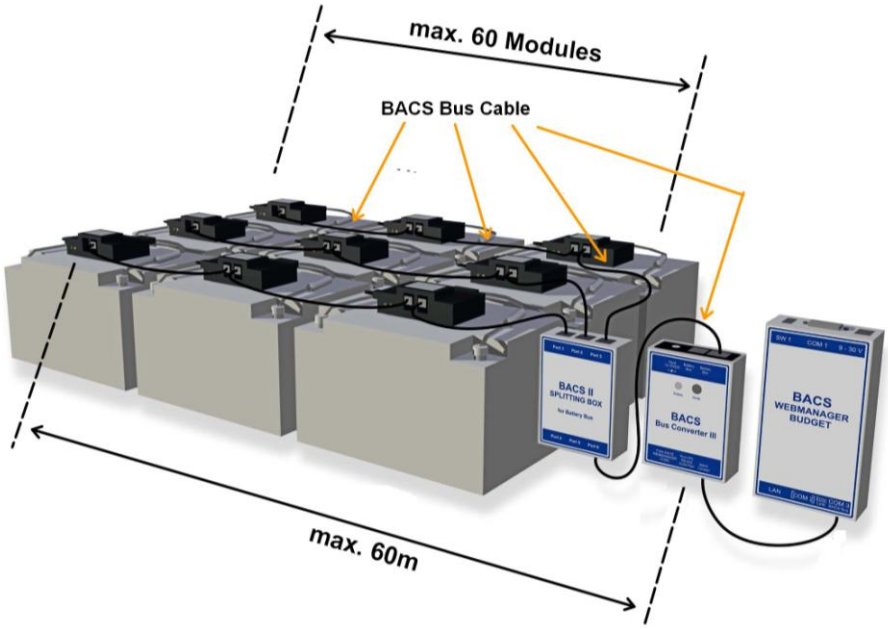

Figure 14: BACS bus cables connected to a SPLITTBOX - CONVERTER – BACS WEBMANAGER

The BACS bus connection cables are specially designed products (using twisted cables and special covering) the cables are available in different length. We strongly recommend using these cables to avoid false alarms through EMI or other noise.

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Tip! You can connect the modules to the bus in random order. It is not necessary to connect the modules to the bus in serial (i.e. in a 'daisy-chain'). We recommend arranging the bus wiring in such a way as to avoid excessive bus cable length.

Tip! You The bus system can carried out in a closed loop for a better data transfer. In case of one contact problem in the circuit it possibly also can be solved evenso.

1.1.3 Connect BACS Bus Cables to Converter & Webmanager

The BACS BUS CONVERTERs provide a galvanic isolation of the battery bus from the BACS WEBMANAGER; additionally it filters possible EMI and converts the BACS bus protocol to an RS232 protocol. The active EMI filter in the BACS BUS CONVERTER requires a power supply 12 – 18 VDC.

The BACS Battery bus cables are connected to the first BACS module in your system or to the BACS SPLITTINGBOX. The other side has to be connected with the BACS WEBMANAGER, using the included 1 m cable.

Attention ! Do not connect any BACS bus cable type B2BCRJxxx into the COM3/AUX port of the BACS WEBMANAGER ! This port is designed for the usage with the 6-pin original cable, which is containing into the scope of delivery of every BACS WEBMANAGER. If any other cable will be connected here, it could damage the contacts and might cause addressing and communication problems with your BACS BUS CONVERTER and BACS Modules !

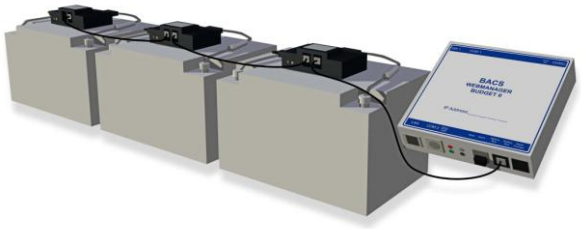

Figure 15: BACS WEBMANAGER BUDGET II typical setup

There are several different types of BACS BUS CONVERTERS. Depending on your model, please connect the BACS Bus cable from the first module or BACS Splitting box to the BACS BUS CONVERTOR and install the Power supply cable to the box. The Bus cables connects the convertor to the BACS WEBMANAGER BUDGET. If you are installing the BACS WEBMANAGER BUDGET 2 the BUS CONVERTER is now incorporated into the BACS WEBMANAGER and no extra power supply is required. The BACS cable from the first module or BACS splitting box is connected direct to the BACS WEBMANAGER.

Figure 16: BACS Webmanager Budget II with integrated CONVERTER

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Figure 17: BACS Bus Converter III for use with BACS WEBMANAGER BUDGET slot cards and External

1.1.4 FINISH Step 1: Finish the Installation of the BACS Hardware

The installation of the BACS sensor, consisting of BACS measuring cables, BACS C modules, BACS bus cables, BACS SPLITTING BOX and BACS CONVERTER is now finished.

At this point the BACS modules are not yet functional. The modules are not addressed yet generally. You can do this via the BACS PROGRAMMER Software (for Windows) or via the BACS WEBMANAGER directly. Now we have to configure the BACS WEBMANGER to set up the addressing of the Modules.

The installation of the hardware is now finished. Please take a look into chapter 2 for the configuration of the BACS WEBMANAGER.

2. Configuration of the BACS WEBMANAGER

BACS® WEBMANAGER BUDGET

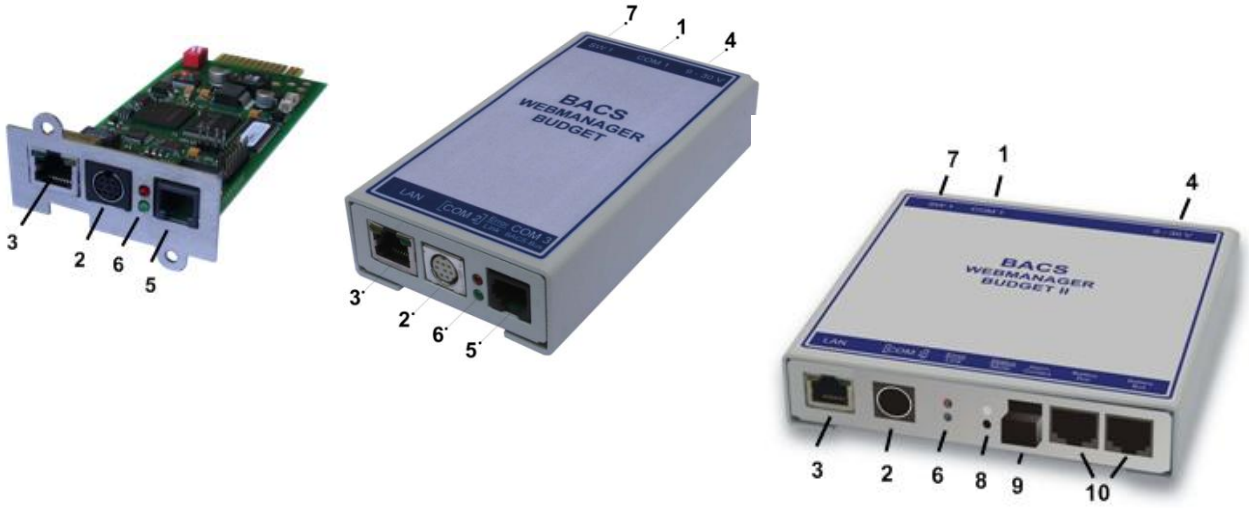

Figure 18: BACS WEBMANAGER BUDGET external, this is also available as SLOT card for UPS

Description	Function
1 COM1	Connection with an UPS or another end-device via a RS232-cable.

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connector	
2 COM2 connector	Connection for optional devices like a modem, multi sensor SENSORMANAGER, temperature sensor, humidity, field busses (MODBUS, RS232, Profibus, LONBus, etc.).
3 LAN-Socket	Ethernet 10/100 Mbit interface with integrated LEDs (green LED: connection to the network established, yellow LED: network-activity).
4 DC-Input	Power supply 12VDC/1A stabilized through external power supply, DC-connector inside (-) minus, outside (+) plus.
5 COM3 connector	For the connection to the BACS® CONVERTER (at BUDGET II/III internal), max.1m Rj12/6pole cable
6 LEDs (red and green)	Optical displays (red = Boot process/error, green = ok).
7 DIP-Switch	For the switch between configuration mode (both switches off) and normal mode (switch 1 on, switch 2 off).
8 Alarm LED	Alarm LED of the integrated CONVERTER (BUDGET II only).
9 MUTE Button	Button for the acknowledgement and mute of the horn. Alarm LED changes to yellow.
10 BACS Bus	2 x Rj10 ports for connection to the BACS C-Module / SPLITTINGBOX / BACS_CSXXX / GX_R_AUX devices.

BACS® WEBMANAGER BUDGET LED Status

Operating Conditions of BACS Webmanager LEDs	**LED-Signalling**
Start procedure 1, uploading of the OS	red flashing
Start procedure 2, reboot of the OS	red long on
If the red and green LED shine at your BACS Webmanager during the reboot, large broadcast traffic is present on your network „receive buffer overflow“. The green LED is signalizing at the reboot, that the „traffic buffer“ is full. Advice: You should filter broadcasts via your switch, because it comes to performance losing of the BACS Webmanager unnecessary.	red AND green during reboot
Normal condition	green flashing
UPS communication lost	red constantly

2.1 Setup and Network Configuration of the BACS WEBMANAGER

Note: We recommend the following settings for the operation of the CS121 via cross cable (Ethernet cable for the connection directly). Set the IP address of the PC with a cross cable to an IP address of the same network segment, e.g. 10.10.10.11 AND set the gateway to 0.0.0.0.

2.1.1 Installation/Network-Integration of the BACS® WEBMANAGER

Connect the power supply to the BACS WEBMANAGER BUDGET and connect a network cable to your Network Switch or to your PC/ workstation network card (cross cable required).

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A network cross cable is a PC-PC network cable which does not require a switch or a hub between 2 network computers (2). If you do not have such a cross cable, please connect the BACS WEBMANAGER and your PC to a switch or hub (1).

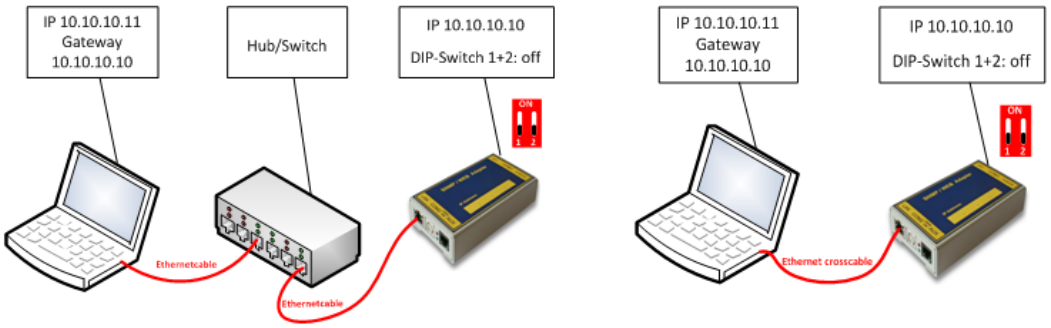

Figure 19: (1) Connection PC-Switch/Hub and CS121 (2) Connection PC-Cross-Cable/Network Cable and CS121

A BACS WEBMANAGER BUDGET Slot (slot card for UPS with SC-Slot) is supplied via the internal power supply of the UPS.

Figure 20: BACS WEBMANAGER BUDGET SLOT card for UPS

NOTE: You can remove and re-insert the slot card to the UPS at any time - (e. g.: to interrupt the power supply for the BACS WEBMANAGER). The UPS function is not affected by removing, inserting such a Slot card.

2.1.2 Network integration of the BACS WEBMANAGER

DIP-Switch: (allocated on the top of the SLOTCARD, at external versions on the rear side) Set the DIP-Switch 1 and 2 into the position OFF. This activates the configuration-mode of the BACS WEBMANAGER BUDGET and its IP address 10.10.10.10.

Automatic IP Addressing: If you set DIP SW 2 to Position ON, DHCP is enabled and the IP address is set automatically. Check the MAC address of your BACS WEBMANAGER to identify the IP address in the DHCP Servers hostname/IP cross reference table.

(Optional,** only if a UPS is connected to COM 1 – if no UPS or other device to manage, skip this step**)

Connect the WEBMANAGER to the UPS: Connect the original serial interface cable of your UPS to the COM port 1 of the WEBMANAGER.

NOTE : The BACS user manual describes exclusivly the Batterymanagementfunctions. The Networkmanagementfunctions are not described in this manual. For configuration of a UPS, timeserver, SNMP etc. we refer to the **"CS121 user manual"**, which is part of this Documentation CD ROM or available as download from the UPS or BACS Website of your supplier. **The CS121 is fully integrated into your**

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BACS WEBMANAGER and all UPS functions and the general usage of flexible EVENTS etc. are described in this separate manual.

For the latest version of the CS121 user manual please follow the link below:

CS121 user manual

2.1.3 Testing the Network Connection

To get a connection to the BACS WEBMANAGER BUDGET through a network cable, you have to integrate it into the IP segment of your computer. In DIP SW 1 position ON the device is set to the default IP address 10.10.10.10. To reach this IP address, you have to set a temporary IP route from your computer.

Open a command prompt window, (open a "DOS BOX" or enter "cmd.exe") and enter in the command prompt

„route add 10.10.10.10 <your local IP address>"

Example: "route add 10.10.10.10 192.168.222.54"

Now you should be able to send a ping to the WEBMANAGER on address 10.10.10.10 and connect with your web-browser to start the configuration.

Note: The internal web-server takes a while to get started. Approximate 3 to 5 minutes after the first start of the WEBMANAGER; the UPS status LED should change from static red (boot phase) to green flashing. This indicates that the web-server is ready now.

Now you can use a web-browser to connect to the BACS WEBMANAGER **via http://10.10.10.10**

Alternative: Follow this link to get the „Netfinder" Software, which will scan your network environment:

http://www.generex.de/generex/download/software/install/NetFinder.zip

2.1.4 Setup the http-connection and login

Connect the web-browser (MS-Internet Explorer and Mozilla supported) to the address **http://10.10.10.10** to reach the configuration web-interface of the Webmanager. Use for the login the **username „admin"** and the predefined **password „cs121-snmp".**

2.1.5 Configuration of IP Address/BACS System on BACS WEBMANAGER

Basic Network Settings: Click the „Network & Security" button. Set the "Local Address", "Gateway Address" and "Subnet Mask" ("DNS-Server" if required). Click the "Apply" button to confirm your settings. Click the „Timeserver" button. Set the IP address of a timeserver service. The timeserver settings are important; because of the logging data of events and alarms (if the web-adapter is not able to reach a timeserver, the default time is the first of January 1970). Click on every page the "Apply" button to confirm your changes.

Finally click on **"SAVE, EXIT & REBOOT"** and wait until the web-browser loses the connection to the BACS WEBMANAGER.

2.1.6 Switching into the Normal Mode

After the BACS WEBMANAGER has rebooted, (takes about 3-5 minutes) it will respond again on IP address 10.10.10.10. To activate now the new configured IP address, set the DIP-Switch 1 into the position ON and disconnect the power supply for a cold-boot (power cycle). This time the BACS WEBMANAGER will use the new, configured IP address and does not respond to IP address 10.10.10.10 anymore.

Connect again now with a web-browser to the new configured IP address (http://<IP address of the adapter) and continue the SETUP of your system.

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NOTE: DIP SW 2 is for DHCP – if you set DIP SW 2 to Position ON, the BACS WEBMANAGER will automatically try to get an IP address from your DHCP Server. To find the new IP address of your BACS WEBMANAGER, please refer to your DHCP Servers Mac Address table and compare with the MAC Address label on your BACS WEBMANAGER.

2.1.7 UPS configuration

(Optional, only if a UPS is connected to COM 1 – if no UPS or other device to manage, skip this step)

UPS Model: Click the „UPS-Model & System" button. Set your UPS model, which is connected to the WEBMANAGER. Click the "Apply" button to confirm your settings. For further information on how to set-up a UPS in the BACS Webmanager, **we refer to the CS121 user manual, which is part of this documentation CD ROM or available as download from the UPS or BACS Website of your supplier.**

Step 2 is now finished.

Your BACS WEBMANAGER is integrated into your network. Please continue now with Step 3: "BACS Configuration".

3. Quickstart - BACS Configuration

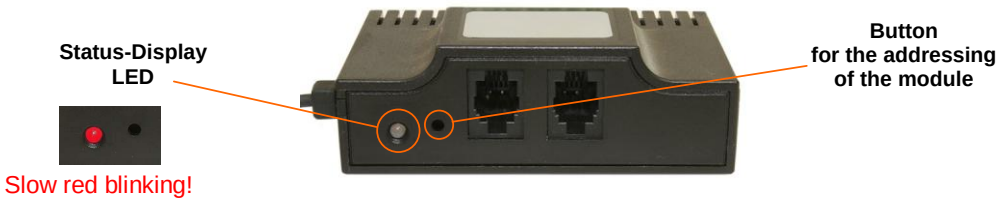
3.1 BACS Configuration

If the BACS modules have not been already pre-addressed by your supplier (optional service, Part No. "BACS_PGM"), the BACS modules will blink slowly red the moment the BACS WEBMANAGER has been connected. (Default status, address = 0) If all modules have been already been addressed, the BACS modules will show a slow green flashing LED (no BACS communication) or a green static LED (Operating mode).

Note: If your modules are already pre-addressed (is displayed via green flashing), please continue with step 4!

3.1.1 Addressing the BACS Modules

At slow blinking red LED your modules are in default address 0. New BACS modules will be delivered with the address "0", displayed through slow flashing red light.



It is required that ALL BACS module are in this state prior to starting the addressing process!

If this should not be the case, please read chapter 4.2, how to reset the BACS modules to factory settings.

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3.1.2 Enter Battery Information

Go with your web-browser to the “BACS Configuration” menu.

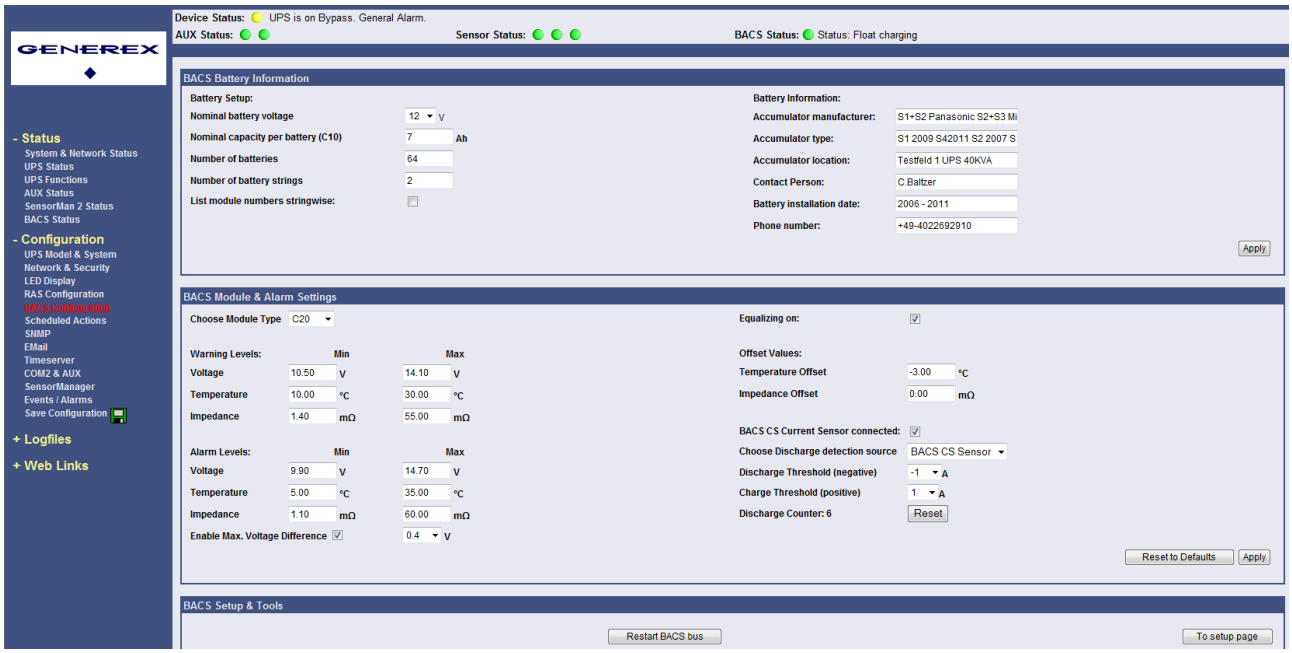

Figure 21: BACS Battery Information

First enter the number of batteries/BACS modules connected to the BACS WEBMANAGER.

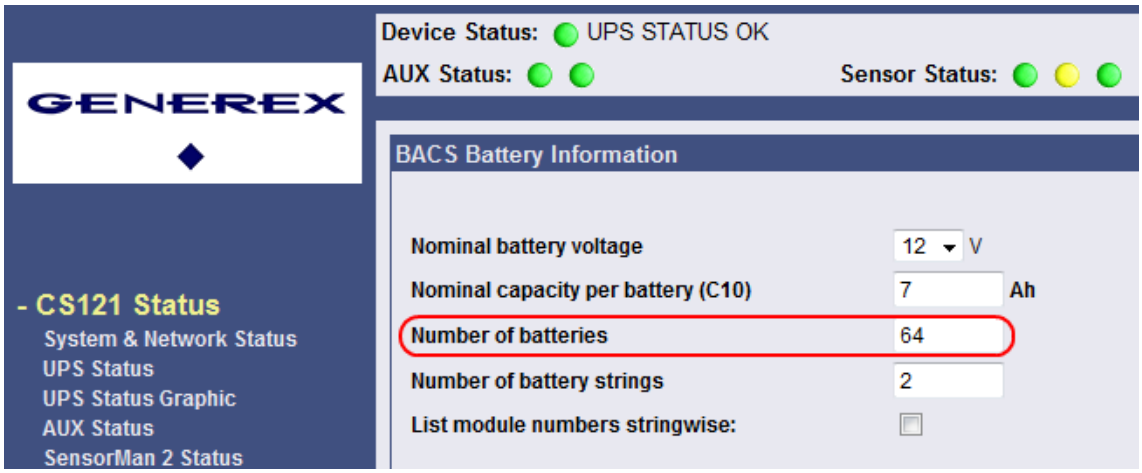

Figure 22: Enter Number of Batteries

E.g. If you got 64 batteries in 2 strings, please enter 64 into the area “Number of batteries” and 2 into “Number of strings”.

After having entered the number of battery strings, you may define how the battery is shown in the BACS web-interface BACS STATUS screen. If you tick the box “List module numbers string wise”, the BACS STATUS screen will list the address number of the batteries string wise, e.g. At 2 Strings with total 64 batteries you will see at string 1 the addresses 1-32 and at string 2 the addresses 1-32.

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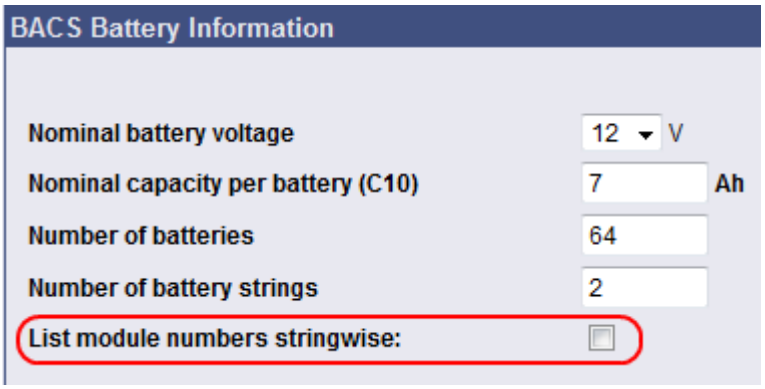
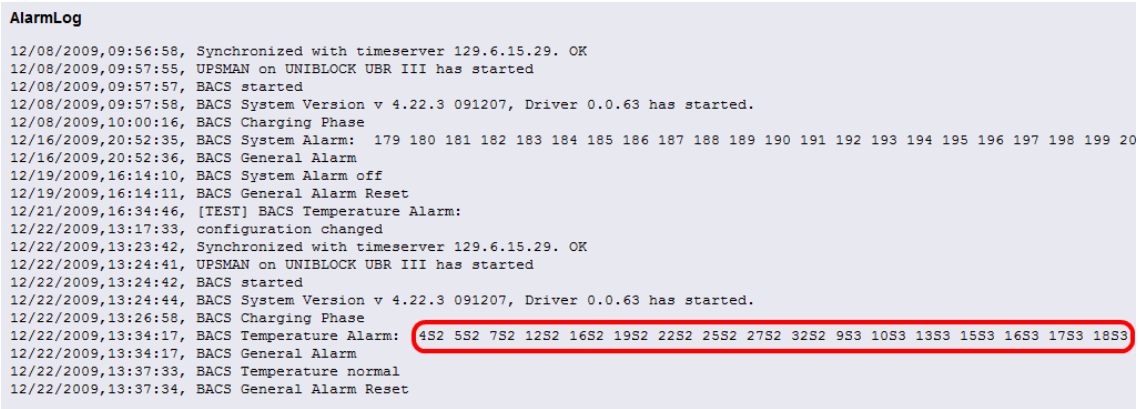


Figure 23: BACS Feature “List module numbers string wise”

If you have enabled the feature “List modules numbers stringwise”, the BACS log file will identify the batteries per string with a text prefix like: “4S2” which means “module 4, string 2”. This makes the identification of the BACS module with an alarm easier for you. The following figure shows the alarm log file of a BACS Webmanager where a temperature alarm was present on several modules, here identified with their string number.



AlarmLog

```
12/08/2009,09:56:58, Synchronized with timeserver 129.6.15.29. OK
12/08/2009,09:57:55, UPSMAN on UNIBLOCK UBR III has started
12/08/2009,09:57:57, BACS started
12/08/2009,09:57:58, BACS System Version v 4.22.3 091207, Driver 0.0.63 has started.
12/08/2009,10:00:16, BACS Charging Phase
12/16/2009,20:52:35, BACS System Alarm:  179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 20
12/16/2009,20:52:36, BACS General Alarm
12/19/2009,16:14:10, BACS System Alarm off
12/19/2009,16:14:11, BACS General Alarm Reset
12/21/2009,16:34:46, [TEST] BACS Temperature Alarm:
12/22/2009,13:17:33, configuration changed
12/22/2009,13:23:42, Synchronized with timeserver 129.6.15.29. OK
12/22/2009,13:24:41, UPSMAN on UNIBLOCK UBR III has started
12/22/2009,13:24:42, BACS started
12/22/2009,13:24:44, BACS System Version v 4.22.3 091207, Driver 0.0.63 has started.
12/22/2009,13:26:58, BACS Charging Phase
12/22/2009,13:34:17, BACS Temperature Alarm:  4S2 5S2 7S2 12S2 16S2 19S2 22S2 25S2 27S2 32S2 9S3 10S3 13S3 15S3 16S3 17S3 18S3
12/22/2009,13:34:17, BACS General Alarm
12/22/2009,13:37:33, BACS Temperature normal
12/22/2009,13:37:34, BACS General Alarm Reset
```

Figure 24: Alarm Logfile with temperature alarm on BACS modules with string numbers

UPS with centre tapping / positive and negative strings. If the battery system of your UPS is using « centre tapping » (where one string is the positive string and the other string negative string, both strings have their individual charger) than you have to configure your BACS system with at least 2 strings (or more).
Explanation: It should be avoided that battery voltage between the 2 strings are not the same due to separate chargers for the positive and negative strings. To assure an ideal Equalisation at different string voltages (+ and – string), it is required to set the amount of strings into the BACS configuration to “2” or higher. By configuring more than 1 string, the BACS configuration will change the Equalisation process to work only within each string. Now every string is handled individually by the BACS system.

(Examples:
2 parallel strings -> BACS configuration number of strings = 4
3 parallel strings -> BACS configuration number of strings = 6; etc.)

The following UPS types are well known to work with 2 strings or more and should not be configured as single string systems: NEWAVE Concept Power Series, AEG Protect Type 3. Modular, Socomec DIGIS, Rittal PMC Extension, INFORM Pyramid DSP.

Please refer to your UPS manufacturer for further information about your UPS system if you are unsure how many strings to enter.

Note: The new BACS C-Modules will go into “Sleep” mode automatically, if the BACS WEBMANAGER is not polling. That means that the modules seem to be off, as long as the BACS WEBMANAGER is not connected. To wake up the sleeping modules you have to connect the BACS Webmanager and open the configuration page, after a while the modules will wake up.

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3.1.3 Enter BACS SETUP PAGE to address your BACS Modules

If all modules are flashing slow red light click on the “To Setup Page” in the menu “BACS Setup & Tools” button.

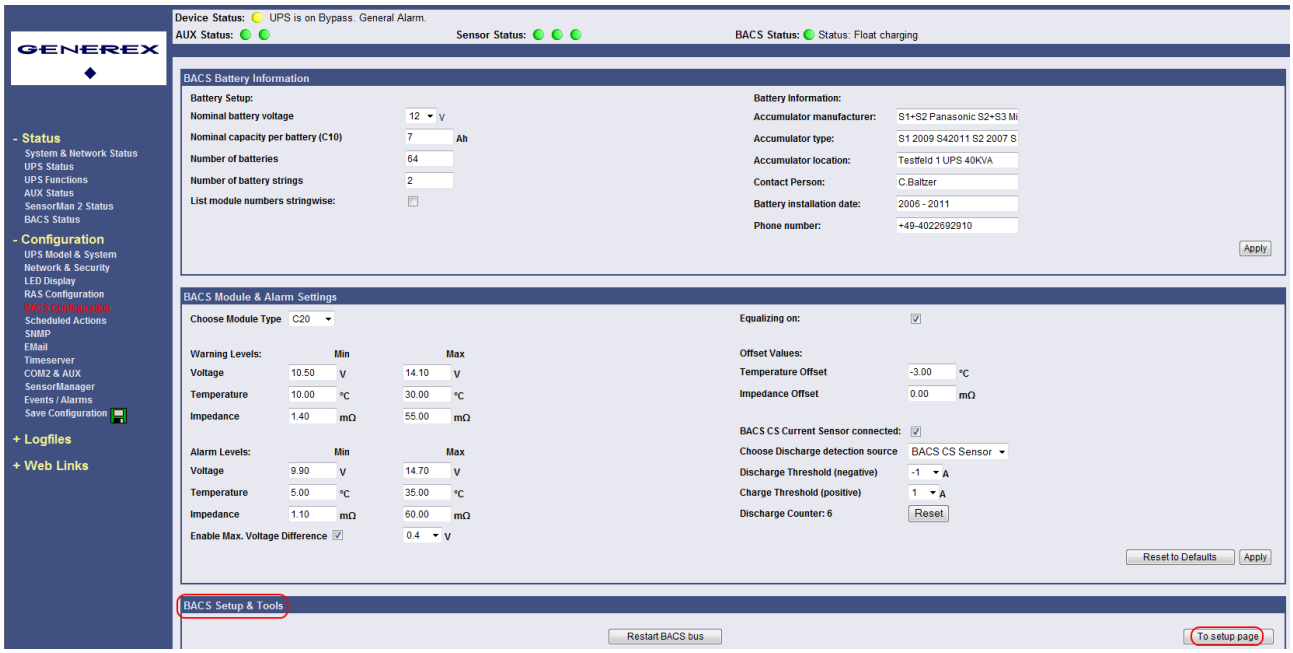

Figure 25: Web Interface BACS Configuration

Click the “Enable” button to interrupt the normal operation of the BACS system. The polling and the initializing of the modules will be stopped. This page offers setup features for the addressing of the BACS modules.

Do not forget! After your address work is finished, click the “Disable” button to reactivate the normal operation, the polling and the initializing of the BACS system.

3.1.4 Start Addressing the BACS modules using the Setup Automatic Tool

After the page is active, you may now start addressing your BACS modules using the **BACS Setup Automatic Tool.**

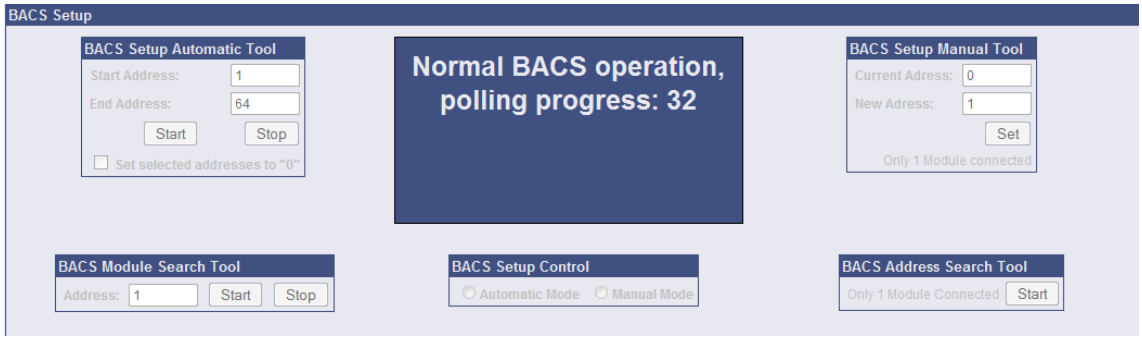

Figure 26: Web-Interface BACS Setup & Tools

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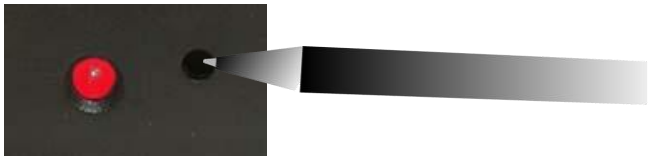
BACS Setup Automatic Tool
You have the choice between « automatic mode » and « manual mode ». In Automatic mode all modules will be addressed by a consecutive click on the address button of every module. Starting from no. 1 to the last module. In Manual mode you can set the address numbers individually!

BACS Setup Automatic Tool usage
In the **BACS Setup Automatic Tool** the addresses will be set consecutively. Set a start- and an end address. E.g. if you got 64 batteries, set 1 as start address and 64 as end address and click the « Start » button.

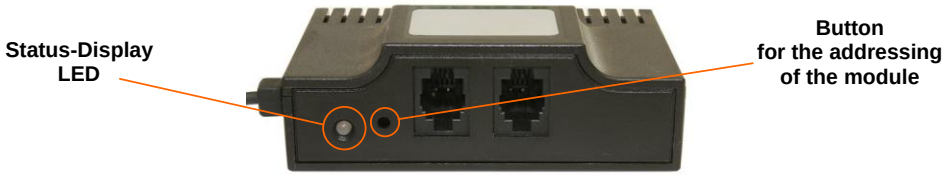
The system will now start the addressing mode and you should see that **ALL** modules change from slow red flashing to fast red flashing.

Status-Display LED is fast red flashing = Adressing mode active ! Press adress button with any pointy object to adress this module to the next number



Fast red flashing indicates “addressing mode”. As soon as all modules show fast flashing LEDs, you can automatically address the modules by a short click (with a pen or any other pointy object, e.g. a pen etc.) on the address button in the module. This will make the fast red flashing LED turn green – indicating that you successfully have addressed this module.

If not all the modules flash fast red, please see chapter 4.2 « Reset to Factory Settings ».



The moment the button is pressed, the red fast flashing LED turns green and you hear a beep at your Computer if you use the Windows BACS Programmer tool. Every “beep” indicates that the next higher address (starting from ”1”) has been successfully set. At the web-browser programming interface there will be no “beep”, but a green text messages shows the successful addressing procedure (see below).

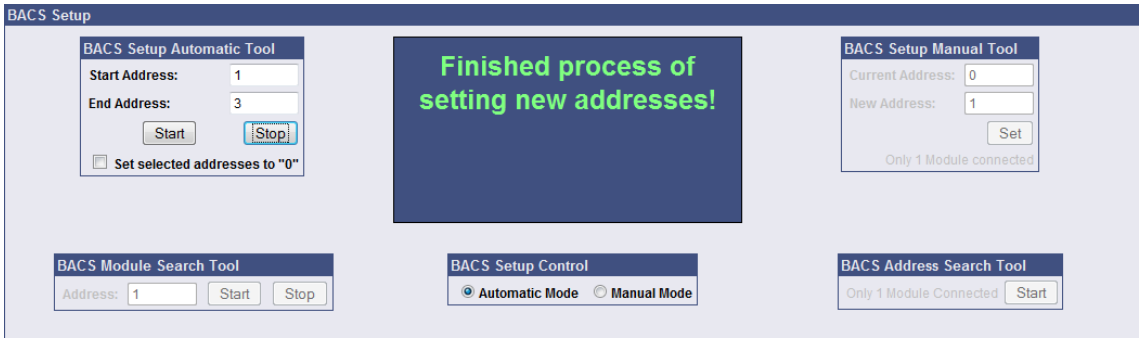


Figure 27: BACS Web-Browser Programming Interface - Finished Addressing Process

Continue now with the next module, which becomes addressed now as no. 2. Continue this process until the last module has been addressed.

Finally click STOP to tell the system, that the addressing mode is finished.

All modules should show a green static LED now. Congratulation! You have successfully addressed all your BACS modules!

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Tip: Automatic mode partial addressing
Due to installation reasons, you may want to address your BACS modules step-by-step, e.g. addressing number 1 to 32, than later from 33 to 64. If an error occurs at the automatic addressing, a message with the accordant address will appear. It is required to restart the addressing from the address number, where the error occurred or use the manual mode to correct the address.

FINISH: Execute the « Save, Exit & Reboot » function into the « Save Configuration » menu now, to start the first time with BACS measuring.

4. Quickstart - Starting BACS the first time

After having started BACS the first time, you will first see the start-up screen.

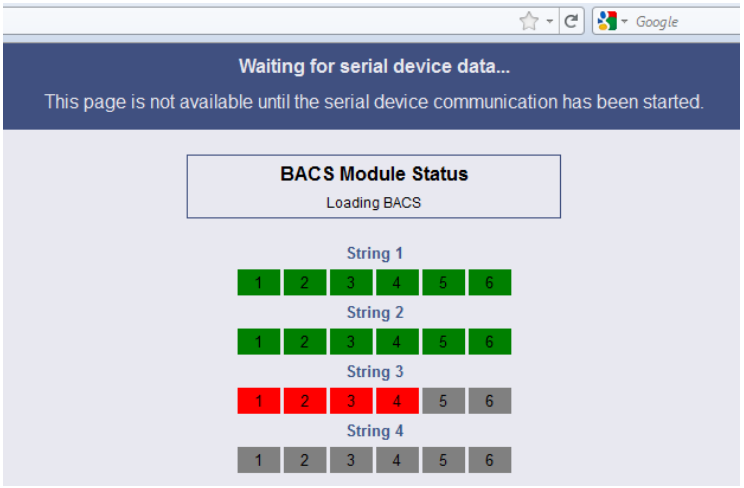
Google
Waiting for serial device data...
This page is not available until the serial device communication has been started.
BACS Module Status
Loading BACS
String 1
1 2 3 4 5 6
String 2
1 2 3 4 5 6
String 3
1 2 3 4 5 6
String 4
1 2 3 4 5 6

Figure 28: BACS Start-Up Screen (64 Modules)

The colours got the following meaning:

- Green: BACC module initialized = status okay
- Red: BACS module not reachable
- Grey: BACS module not polled/initialized yet

If BACS has initialized all modules successful, you will see the BACS status page, with Voltage and Temperature of the batteries, Equalisation power and the status LED. After 15 minutes the first measuring results of the impedance is made. Please wait until the first RI measuring is visible before you continue with **chapter 4.3 "*BACS Module & Alarm Threshold Setting".***

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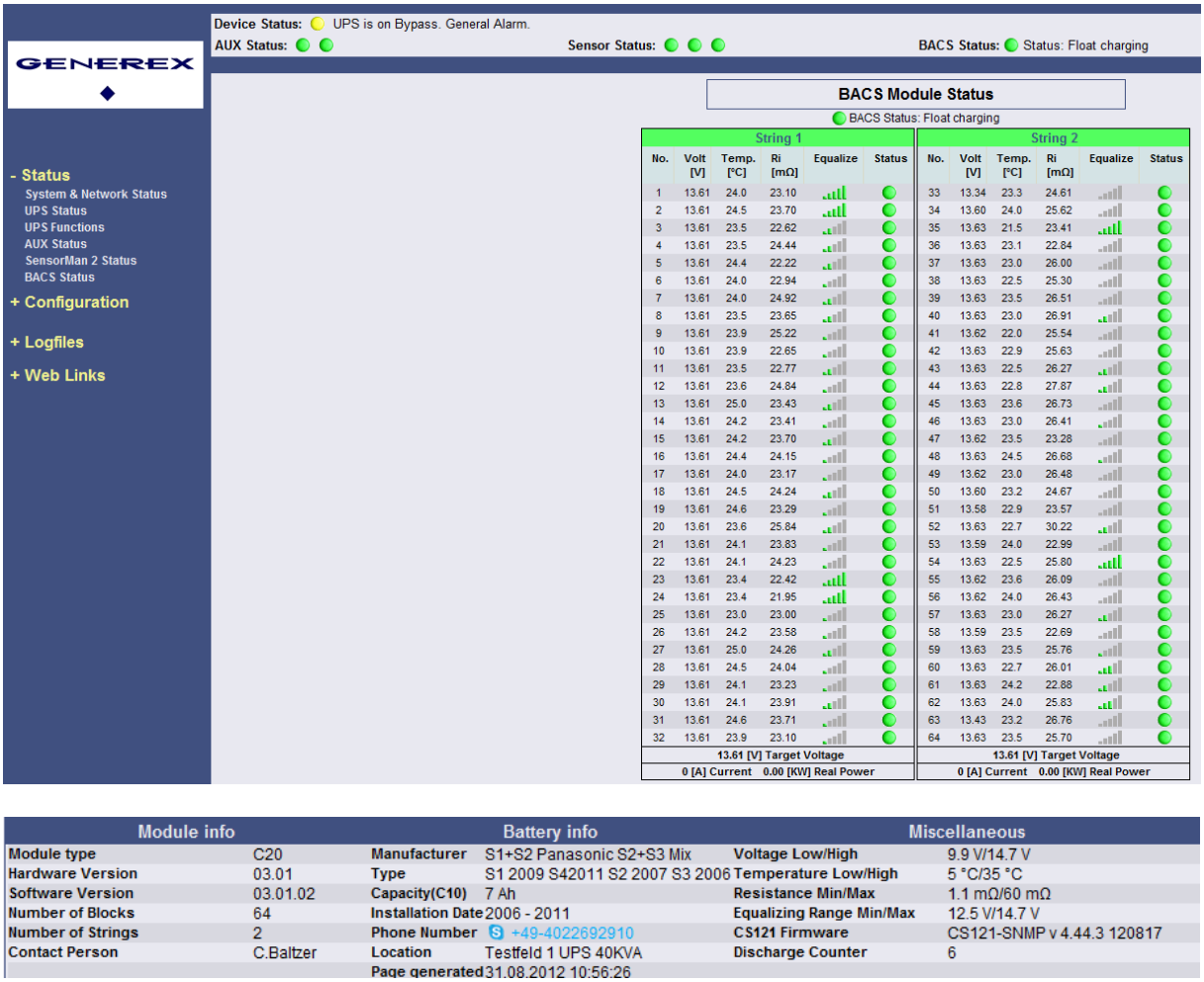

Figure 29: Web-browser BACS Status Page (64 Modules)

End of the BACS QUICKSTART. For further configuration description and complete information how to use the BACS system, please use the complete BACS user manual and its FAQs.

The BACS Programmer Software is a Windows Software, which uses all available functions of the BACS Webmanager for the programming of the BACS modules. If you want to pre-address the BACS modules prior of the installation at customer site, you can use this software and a BACS BUS CONVERTER 3.

Follow this link to get the BACS Programmer Software:

http://www.generex.de/index.php?option=com_content&task=view&id=65&Itemid=106

4.1 (Optional) Using the BACS SETUP page in Manual Mode

Skip this step, if you have already addressed your BACS modules using the automatic mode and continue with chapter *4.2. BACS Module & Alarm Threshold Settings*

BACS SETUP Manual Mode
The “Manual Mode” is for individual addressing of single modules or to correct or alternate addresses at maintenance.

BACS Module Search Tool:
Identification of already addressed BACS modules: You can search in your BACS system for a single module via the menu **BACS Module Search Tool**. The module will identify itself with a flashing red/green LED. Press the addressing button at the module, to confirm that you have identified the module; it will now fall back into the normal operating mode. Optional you may click on the STOP button to make the module fall back into normal operating mode.

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ATTENTION! If you press this button for more than 2 seconds, the module will cancel the addressing mode and will be back into the delivery condition with address 0!
If the addressing button will be pressed for more than 12 seconds into normal BACS operation, the module will be reset to the address 0 and the measuring and regulation function will be switched off too. Therefore a new addressing of the module will be required.

BACS Module Setup Manual Tool:
You can set or alter a single address in the **Manual Mode**. Enter the appropriate address into „Current Address“ and enter the new, desired address into „New Address“. Click the „Set” button to apply your settings. The new address of the module will be displayed in the programmer tool.

ATTENTION! Only one module should be connected at the bus if you use in the Manual Mode the Address Change functions! Disconnect all other BACS modules from the BACS Bus cable except the one you want to change! Otherwise you risk the case of creating the same address for more than one module.

BACS Address Search Tool:
With the BACS Address Search Tool you can ask the BACS modules for its address. In case you find a BACS module which is programmed (Green LED) but it does not answer – you may connect this module to the BACS bus and disconnect all other modules. Now click on START to request the module for its Address. After you know this address, you may use the BACS Setup Manual Tool to alter this address.

ATTENTION! Only one module should be connected at the bus if you use in the Manual Mode the Address Change functions! Disconnect all other BACS modules from the BACS Bus cable except the one you want to change! Otherwise you risk the case of double an addressing more than one module with the same address.

NOTE: Force to switch BACS Modules to addressing mode
If the modules do not start fast red flashing (addressing mode), you can force this mode by pressing the addressing button for 12 seconds. This will force the module to go into the addressing mode and the LED will flash fast red. Restart now the Automatic Mode or Manual Mode to set the address number.

Status LED-Display at the module

Operating State of the Module	LED-Display
Not addressed (delivery status)	Slow red flashing
„Programming Mode“ active	Fast red flashing
Addressed & communication = **Normal condition**	Green constantly
Addressed & actually no communication, no measuring	Green flashing
Out of threshold range, see web-browser, which alarm is actually present	Red constantly
Identification mode	Red/green flashing

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After any change on the BACS configuration do not forget to Disable the configuration page and after this click in the “Save Configuration” menu the button “Save, Exit & Reboot” button and wait for about 3 minutes to restart . As soon as the green LED of the BACS WEBMANAGER is slowly flashing the device is back and ready to continue configurations or monitoring.

4.2 (Optional) Set selected addresses to 0

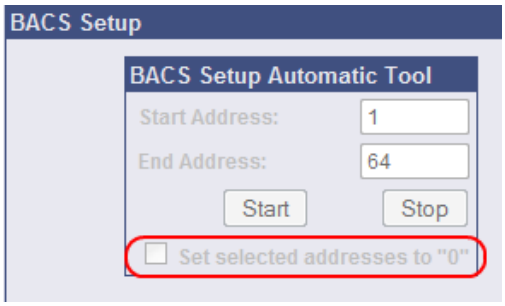

Figure 30: Reset to Factory Settings

If you enable this function, the BACS System will reset ALL addresses to the default address “0”. This may be useful if you find a not correctly addressed system or if you want to setup a new set of batteries. Through this function the modules will be reset to the factory settings. The modules will display the address 0 through red slow flashing. Click on STOP as soon as all your modules flash slowly red and start with Addressing again.

4.3 BACS Module & Alarm Threshold Settings

4.3.1 Configuration of BACS Module & Alarm Threshold

Enter the alarm thresholds for your system in the menu “BACS Module & Alarm Settings”.
Alarm thresholds may be requested from your battery manufacturer or you may define the alarm levels yourself.

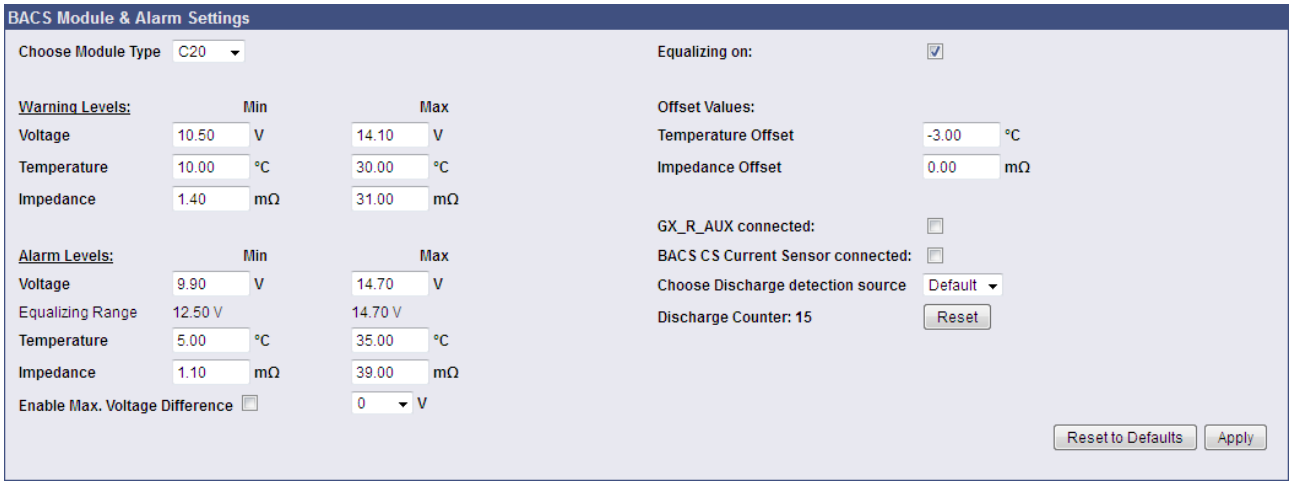

Figure 31: BACS Module & Alarm Settings

BACS thresholds distinguish between “Warnings” and “Alarms”.

Warnings: At warning the BACS Status LED in the Web-browser changes from green to orange. An Email is triggered if the Email on all event function is enabled. NO SNMP Traps will be implemented at this stage, but the EVENT type “Warning” is triggered.

Alarms: At alarms the BACS Status LED in the Web-browser changes from green/orange to red. An Email is triggered if the Email on all event function is enabled. The alarm buzzer and contacts are activated. Alarms also automatically transmit SNMP Traps (if configured) and execute all EVENT types “Alarm”. Alarms are set to the user´s thresholds, so the user defines if any alarm requires immediate reaction and correction of the alarm causing event – or if just the thresholds have to be altered.

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- **Voltage Min.:** Voltage lower limit; if the voltage passes this value an alarm/warning will be triggered.
- **Voltage Max.:** Voltage upper limit; if the voltage passes this value an alarm/warning will be triggered.
- **Equalizing Range** displays the voltage window in which Equalizing is active. Beyond this range (if too high) there will be an Alarm triggered and Equalizing will automatically switch off. Below the window, Equalizing will not start since there is not yet enough charging current available to distribute. By changing the limits for Voltage Alarm thresholds, this window can be altered. Please note that for standard lead-calcium accumulators the default settings are ideal.
- **Temperature Min.:** Temperature lower limit; if the temperature passes this value an alarm/warning will be triggered.
- **Temperature Max.:** Temperature upper limit; if the temperature passes this value an alarm/warning will be triggered.
- **BACS impedance alarm threshold:** Value of the impedance, if exceeded an alarm/warning will be triggered.
- **Enable Max. Voltage Difference:** You can define a difference value (0 – 1) by yourself. If the value will be exceeded, a "BACS Voltage Difference Alarm" will be triggered.
- **Equalisation on:** Switching on /off the Equalisation function.
- **BACS CS Current Sensor connected:** Switching on / off of the optional BACS current sensor logging.
- **Choose Discharge detection source:** You can select a source, which should be used as discharge detector (default = voltage drop, (slow detection)). If you select "UPS" or "BACS_CS CurrentSensor", the detection will be faster and will deliver more accurate values for the logging into the BACS Viewer.
- **Discharge Counter:** It is a simple counter for the amount of discharges since the installation of the firmware. It is a pure statistical function. The BACS Viewer can display more accurate, where a discharge was and where just a minimal voltage drop occured.

Advice: Please note the following advices for the determination of the thresholds:

- **Voltage thresholds:** Voltage differences will be balanced within 24 hours, if EQUALISATION is enabled. If the voltages still keep differing more than 0.50 Volt after 14 days, although Equalisation is active with 100%, than the cause may be a faulty battery and should be checked.

- **Temperature thresholds:** The ideal temperature range for lead batteries is between 20 to 25°C. Temperatures below 20°C are admissible, although it should not become less than 5°C below 20°C permanently. The lower threshold of the temperature is set per default to 10°C. In contrast the upper value should be set so, that at an alarm or warning is given if the batteries gets too hot. Because batteries to grow warm during the charging and discharging process, the temperature range should be set higher than the expected normal room temperature to avoid false alarms. Normally the temperature of a battery rises about 10°C during discharging/charging. That means at a normal temperature of 20°C, the alarm threshold should be set at 30°C. Increasing to 35°C over a long time a damage of the battery could occur and should be monitored. Additionally if the higher temperature after the charging or discharging process does not return to a normal value within 10 to 15 hours, a defect may be present in your battery system (charger or battery problem). At any alarm, double check the measured values manually before starting actions. Do not tolerate high temperature alarms over longer periods; this could also be a warning of a dangerous "thermal runaway" effect of corrupted batteries which could finally end in a fire.

- **Internal resistance:** Ideally the measurement values of the internal resistance of new accumulators should be within a short range of each other and should not differ more than 20% from the average impedance of all accumulators. Example: If you can see that the majority of your batteries are at e.g. 15mOhm (example for a small 7Ah battery), than the accepted tolerance should be max. +/- 20%, which is 17 – 23 mOhm). The alarm threshold should be set at + 30% of the upper accepted limit – which results in this example at 29.9 mOhm as Warning Threshold.

Accumulators with the same age and the same type, but show impedance varying more than 20%, should be checked. To make sure that it's not a measuring problem, check that the if the measuring cable is correct firmly to the BACS module. To prove if the BACS module is the source of problem, please change with any other, correct measuring module to see if the results are changing now or not. If this check also shows no problem at the Measuring components, the problem is the battery or the battery connectors!

NOTE: Please wait at least 15 minutes after BACS has been started before you continue to set the alarm levels for Impedance. The BACS system is measuring Impedance the first time 15 minutes after reboot. Another 3 measuring are taken within the following 45 minutes to precise the first measuring. After 60 minutes the system re- measure impedance every 24 hours. So we recommend you start to set the RI

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thresholds 60 minutes after the BACS WEBMANAGER has booted to avoid false alarms because of the correcting of the measurement during the first 60 minutes.

After having defined the warning and alarm thresholds, press APPLY button to confirm your settings. Restart the WEBMANAGER, click the “Save Configuration” button and click the “Save, Exit & Reboot” button and wait until the device has rebooted and shows the first measuring. If now all you’re measurements are within the defined limits your *BACS Module & Alarm Threshold Settings* is finished and your system is ready for use.
The following chapter 5 explains the display and history log files of the BACS system. Chapter 5 is for the end-user or the Battery service company.

4.3.2 Configuration of BACS Offset Values

In this configuration you can adjust the measuring of the BACS system to your reference handheld measuring device. With negative or positive values for temperature and impedance you can now setup the BACS system to correspond to your reference system, for any easier overview and comparison of manually created reports.

Impedance Offset: Change BACS measuring to your reference RI measuring device. E.g. by -2.2 you would deduct 2.2 milliohm from the real BACS RI measuring on all BACS modules. A positive value would add this offset to all BACS modules and show a higher value than the BACS raw data. Please note, that such offsets should be noted in your battery reports.

Temperature Offset: Change BACS measuring to your reference thermometer. E.g. by +2.0 you would add 2 °C to the real BACS temperature measuring on all BACS modules. A negative value would deduct this offset to all BACS modules and shows a 2°C lower temperature than the raw data. Please note, that such offsets should be noted in your battery reports.

5. Monitoring with BACS

5.1 Monitoring with BACS STATUS PAGE

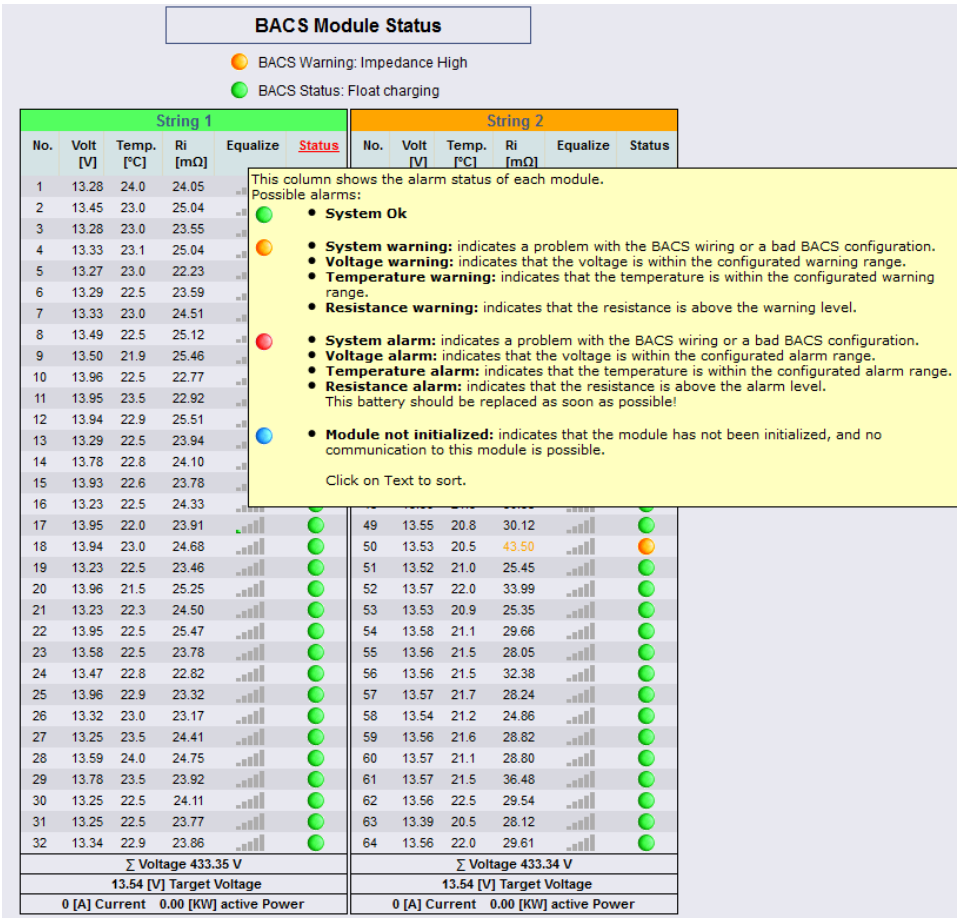
BACS Module Status
BACS Warning: Impedance High
BACS Status: Float charging
String 1
String 2
No. Volt [V] Temp. [°C] Ri [mΩ] Equalize Status
This column shows the alarm status of each module.
Possible alarms:
System Ok
System warning: indicates a problem with the BACS wiring or a bad BACS configuration.
Voltage warning: indicates that the voltage is within the configurated warning range.
Temperature warning: indicates that the temperature is within the configurated warning range.
Resistance warning: indicates that the resistance is above the warning level.
System alarm: indicates a problem with the BACS wiring or a bad BACS configuration.
Voltage alarm: indicates that the voltage is within the configurated alarm range.
Temperature alarm: indicates that the temperature is within the configurated alarm range.
Resistance alarm: indicates that the resistance is above the alarm level.
This battery should be replaced as soon as possible!
Module not initialized: indicates that the module has not been initialized, and no communication to this module is possible.
Click on Text to sort.
∑ Voltage 433.35 V
13.54 [V] Target Voltage
0 [A] Current 0.00 [KW] active Power
∑ Voltage 433.34 V
13.54 [V] Target Voltage
0 [A] Current 0.00 [KW] active Power

Figure 32: Web-Browser BACS Status Page showing Equalisation Activity

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Note: The BACS WEBMANAGER firmware version 4.40.x or higher displays, if EQUALISATION is active or not. A grey LED means, that the EQUALISATION is 0%, but ready and will take action, as soon as the voltages will drift apart.

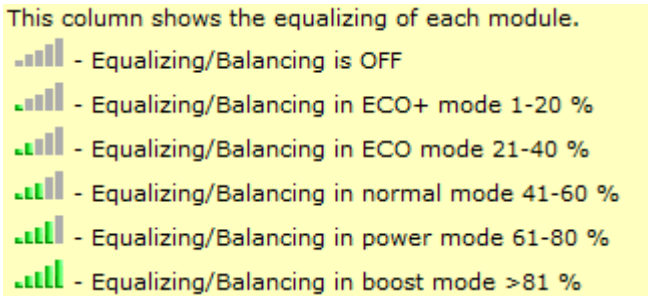
This column shows the equalizing of each module.
- Equalizing/Balancing is OFF
- Equalizing/Balancing in ECO+ mode 1-20 %
- Equalizing/Balancing in ECO mode 21-40 %
- Equalizing/Balancing in normal mode 41-60 %
- Equalizing/Balancing in power mode 61-80 %
- Equalizing/Balancing in boost mode >81 %

Figure 33: Web-Browser BACS Status Page showing Equalisation Activity per Module

Move the mouse pointer over the gray-green bars, to display the exact Equalisation power.

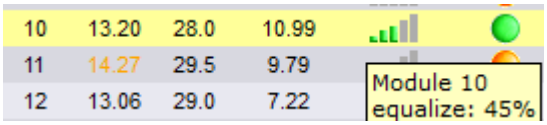

Figure 34: Web-Browser BACS Status Page showing Equalisation Activity Display per Module

The monitoring of the actual battery UPS and environmental data is made through any web-browser and email server and/or RCCMD clients for alarms and warnings. The graphic above shows such a display, here the BACS STATUS page and the overall STATUS of other connected devices displayed in the header. To switch between the BACS, UPS and other status pages, click on the Status LED to display the other STATUS pages, e.g. for UPS, Environmental sensors and alarm contacts. To change the default “welcome screen” from BACS STATUS page to any other STATUS page, please change this in the “Network & Security” configuration of the BACS WEBMANAGER.

The BACS STATUS page
All important data of every single accumulator is displayed on the web-interface status page. The module-number of the accordant module is displayed in the 1st column. You can select the numbering (consecutive or string-wise from 1 –n) for the strings in the “BACS Configuration” menu.
The module voltage is displayed in the 2nd column. By activated Equalisation, at constant charging, all module voltages should be identical, after 1 up to 2 days. Acceptable level is a difference of max. 0.5 Volts at a 12Volt battery. If this is not achieved after 1-2 weeks, sulphation may be the cause. Do a discharge of the batteries to see if the impedance goes down and the batteries have again a chance to get Equalisation during the following recharge process. If this does not have the wanted effect and the batteries keep showing a difference of more than 0.5 volt during supply charge, please contact your battery service to check the batteries or the charger. You can define the difference value into the BACS firmware, that you want to tolerate. If this value will be exceeded, a « BACS Difference Voltage Alarm » will be triggered, which can be defined from 0,05 to 1V.

The temperature of the external BACS modules is displayed in the 3rd column in degrees of Celsius. The temperature of every single battery will be monitored and logged.

The internal resistance of every single battery is displayed in the 4th column. Changes in the value of more than 30% from the average settings needs investigation, please check the concerning battery or rather the module and the measuring cable.

Note: From the BACS WEBMANAGER firmware version 4.38.x or higher the RI measurement will take place step-by-step, after 15 minutes the BACS Modules will be polled individually, with interruptions of 30 to 50 seconds between the BACS Modules.

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If the Equalisation function is activated, it is displayed in the 5th column the actual Equalisation level is in % of the total available Equalisation power. When the module uses less than 50% of the available Equalisation power, this LED turns dark green. If the value is higher than 50%, the equalizing LED turns to lime green. This green light does not show that the batteries are in good shape, it just shows that the Equalisation process is active and actually runs at more than 50%. The longer BACS is installed, the less Equalisation should be needed. If all batteries show identical voltages and Equalisation is dark green on all modules, then you know that only little corrections are needed to keep the batteries in the optimal voltage range.

Alarm and Warnings are shown in the 6th column, called “state”.

- **Green:** The battery is OK, within of the configured thresholds.
- **Orange:** At least one measuring value reached a warning level, but did not pass the alarm thresholds.
- **Red:** The internal resistance, the temperature or the voltage passed the defined thresholds or the communication of the accordant module is actually not active. In addition a “SYSTEM ALARM” will be displayed in red, if one or more BACS modules are not working properly. This means, that NO monitoring is happen and you have to resolve it immediately. System alarms are delayed to decrease false alarms. Example 1: If the connection to one BACS module (nr. 24, cable disconnected) is lost, it will last 4 minutes until the system alarm will be displayed on the web-interface. The alarm contact will be delayed triggered for further 90 seconds. Example 2: If the connection is lost to all BACS modules (bus cable at the BACS WEBMANAGER disconnected), it will last approx. 35 minutes until the first BACS modules will alert a system alarm. The alarm contact will be delayed triggered for further 90 seconds.
- **Blue:** No communication to the BACS module, system is not ready. The module was not found during start up or a configuration error is existent.

Advice: We recommend recording the BACS history files for a periodic inspection, to monitor the behaviour of the measured values. Do a screenshot of the BACS status page from time to time and store this for later inspections. Repeat this process about every 3 months. We also recommend retrieving the BACS log files using the BACS Viewer Software on a regular basis and forward this information to your battery service company for interpretation of the data.

The BACS STATUS page is refreshed on a regular basis. To find easily the highest and lowest values, you may click on the blue header text of every column, to sort the values from high to low or the other way round.

Advice: From BACS WEBMANAGER FirmWare Version 4.35.x : The BACS status was extended: « Target Voltage » will be displayed, if EQUALISATION is *active*. The BACS modules indicate therewith, which value of the voltage is aspired. « Average Voltage » will be displayed, if EQUALISATION is *disabled*. Therefore the latest averaged voltage will be displayed.

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String 1						String 2					
No.	Volt [V]	Temp. [°C]	Ri [mΩ]	Equalize	Status	No.	Volt [V]	Temp. [°C]	Ri [mΩ]	Equalize	Status
1	13.26	24.0	24.05			33	13.27	22.5	41.63		
2	13.40	23.3	25.04			34	13.53	23.0	44.02		
3	13.27	23.1	23.55			35	13.58	22.0	25.53		
4	13.33	23.1	25.04			36	13.56	21.5	26.84		
5	13.25	22.8	22.23			37	13.55	22.0	34.89		
6	13.29	22.7	23.59			38	13.55	22.0	29.77		
7	13.33	22.8	24.51			39	13.56	22.2	31.80		
8	13.55	22.5	25.12			40	13.57	22.2	30.64		
9	13.83	21.9	25.46			41	13.55	21.3	28.54		
10	13.92	22.5	22.77			42	13.56	22.0	32.01		
11	13.92	23.5	22.92			43	13.56	21.0	29.26		
12	13.90	23.0	25.51			44	13.56	22.0	39.98		
13	13.29	22.5	23.94			45	13.56	21.9	30.26		
14	13.92	22.9	24.10			46	13.56	22.5	29.37		
15	13.92	22.9	23.78			47	13.54	21.1	25.58		
16	13.20	22.5	24.33			48	13.56	21.5	30.38		
17	13.92	22.0	23.91			49	13.55	21.0	30.12		
18	13.91	23.0	24.68			50	13.53	20.5	43.50		
19	13.22	22.5	23.46			51	13.52	21.2	25.45		
20	13.92	21.5	25.25			52	13.57	22.0	33.99		
21	13.22	22.5	24.50			53	13.53	21.0	25.35		
22	13.92	22.5	25.47			54	13.58	21.5	29.66		
23	13.54	22.5	23.78			55	13.55	21.5	28.05		
24	13.45	22.8	22.82			56	13.55	21.5	32.38		
25	13.92	22.9	23.32			57	13.57	21.6	28.24		
26	13.35	23.0	23.17			58	13.54	21.3	24.86		
27	13.25	23.5	24.41			59	13.56	21.5	28.82		
28	13.56	24.0	24.75			60	13.57	21.2	28.80		
29	13.76	23.5	23.92			61	13.57	21.5	36.48		
30	13.23	22.7	24.11			62	13.56	22.5	29.54		
31	13.25	22.5	23.77			63	13.39	20.5	28.12		
32	13.35	22.7	23.86			64	13.56	22.0	29.61		
∑ Voltage 433.35 V						∑ Voltage 433.32 V					
13.54 [V] Target Voltage						13.54 [V] Target Voltage					
0 [A] Current 0.00 [KW] active Power						0 [A] Current 0.00 [KW] active Power					

Figure 35: Sort function – sort Web-browser BACS Status Page by Voltage, Temperature or Impedance

Note: From BACS WEBMANAGER firmware version 4.35.x an error message will be displayed, if BACS modules with REV 2.2 and REV 3.0 were mixed into the bus. A mix of different BACS hardware revisions is not possible and BACS does not start. From BACS WEBMANAGER firmware version 4.42.x the sum voltage will be displayed too.

BACS Module Status

BACS Alarm: General Alarm, Communication Lost
BACS Status: Charging
Error: BACS type HW Revision mismatch or uninitialized modules

String 1

No.	Volt [V]	Temp. [°C]	Ri [mΩ]	Equalize (ON)	Status
1	13.81	27.6	n.a.		
2	13.66	26.2	n.a.		
3	13.82	27.0	n.a.		
4	n.a.	n.a.	n.a.		
5	n.a.	n.a.	n.a.		
6	n.a.	n.a.	n.a.		
13.77 [V] Target Voltage					
n.a. [A] Current					

Figure 36: BACS Module HW Revision Mismatch

Note: From BACS WEBMANAGER firmware version 4.35.x the EQUALISATION Min/Max range wil be displayed. The Voltages of all Modules per String have to be within the limits before EQUALISATION will start to operate.

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Module info		Battery info		Miscellaneous	
Module type	C20	Manufacturer	S1=Panasonic S2=mix	Voltage Low/High	9.9 V/14.7 V
Hardware Version	03.00	Type	AGM	Temperature Low/High	5 °C/40 °C
Software Version	03.00.22	Capacity(C10)	7 Ah	Resistance Min/Max	5 mΩ/42 mΩ
Number of Blocks	64	Installation Date	01.05.2009	Equalizing Range Min/Max	12.94 V/14.21 V
Number of Strings	2	Phone Number	+49-4022692910	CS121 Firmware	CS121-SNMP v 4.35.3 110809
Contact Person	C.Baltzer	Location	Q02 Testroom 1	Discharge Counter	0
		Page generated	12.08.2011 13:37:34		

Figure 37: BACS Status – Further Information

5.2 Monitoring with BACS AUX / Dry contacts

Every BACS system provides an AUX interface where the Alarm Buzzer, LED and the Dry contact output can be configured for using such signals for third party alarm systems. The Default settings are shown below and may be adjusted to your external alarm system by the AUX Settings Webpage, “COM2 & AUX Settings”:

Figure 38: BUS CONVERTER Alarm Buzzer/Contact Configuration

6. Analysis of the Battery Data with BACS Viewer

Installation: The BACS Viewer is an easy to use tool for the monitoring and analysing of the logged battery data provided by the BACS Webmanager. The BACS Viewer runs on Windows software and is available for free; this software can be downloaded from your BACS supplier or battery manufacturer´s website, or from here **GENEREX - BACS Viewer**

NOTE: The data interpretation of the BACS Viewer should be carried out by an experienced battery engineer. The decision if a battery can still be regarded as OK or should be exchanged requires a lot of experience and knowledge of the battery installation, its usage and environment. The BACS Viewer shows a lot of information which you may use to make a decision yourself, but the BACS VIEWER is a tool which cannot be blamed if the interpretation of the data is made incorrect. We strongly recommend using the BACS VIEWER as additional tool for examining data, but the decisions for replacing or continuous usage of batteries should be made by experiences battery service engineers.

BACS VIEWER is analysing a very large amount of data, depending on the size and timescale of battery systems you want to analyse. For such complex computing procedures we recommend you use a fast computer to avoid long response times.

6.1 Installation of the BACS Viewer

Extract all files from the download ZIP file into any temporary folder on your Windows computers hard disk. Start the installation by double click on “BacsViewInstall.exe”. After the installation start the BACS Viewer and add your BACS WEBMANAGERs IP address to the list of BACS Devices.

If you start the BACS Viewer for the first time you have to create an entry for a BACS system. BACS Viewer is designed to analyse several BACS installations local or remote. To add the first BACS installation for analysis, click the “New…” button to enter the device data of the BACS system you want to setup. Enter IP address and a description and the password for accessing the BACS WEBMANAGER. After this click on “OK” and “OPEN” this BACS configuration the first time.

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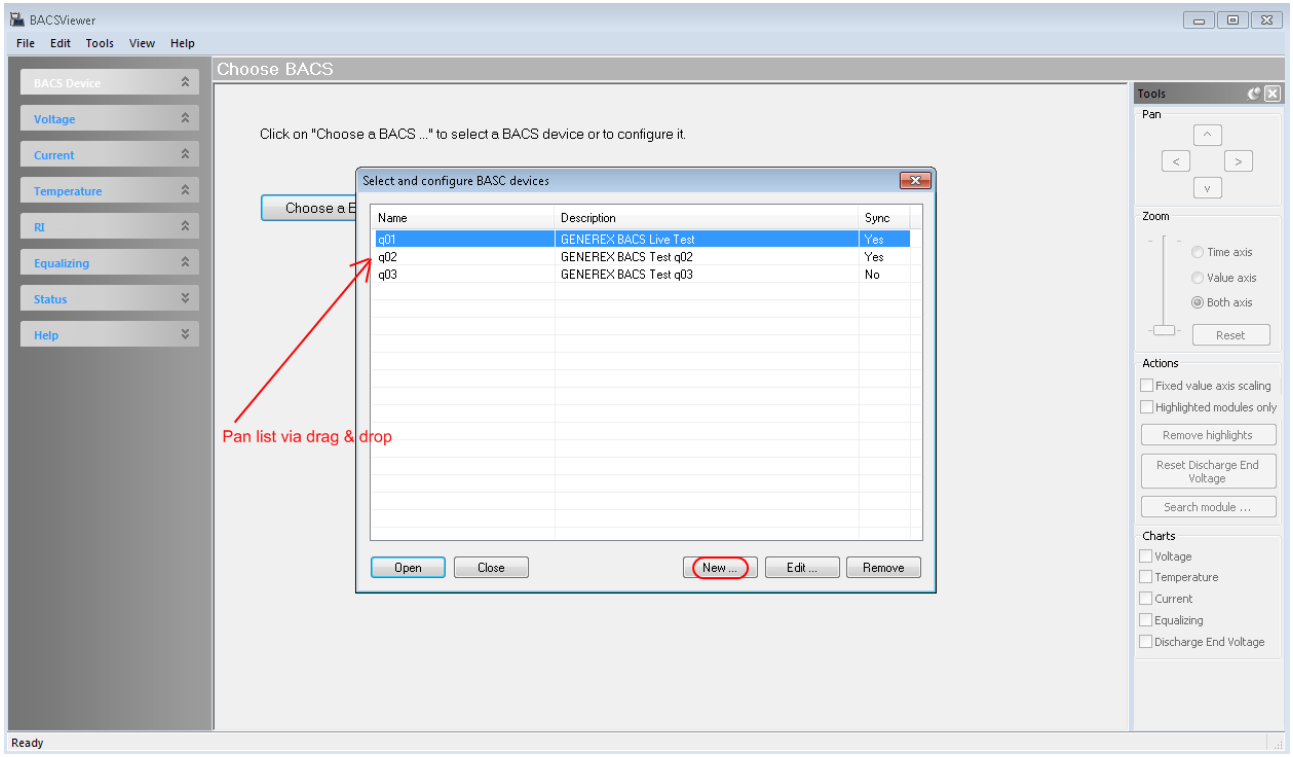

Figure 39: BACS Selection/Configuration

At the start of the program for the first time, no data is found and you have to synchronize the database first – or import log files e.g. With a USB stick or other media, if you do not have network connection to your BACS WEBMANAGER (see chapter 6.5).
The BACS Viewer version 4.1.0.0 provides the function of the pan of the list of the entries via drag & drop. If you select one device with “Open”, the sequential arrangement will be saved, “Close” discards the changes.

6.2 Add BACS Device, Autosynchronization of the BACS Data

Add the IP address or rather the hostname of your BACS WEBMANAGER to the list.

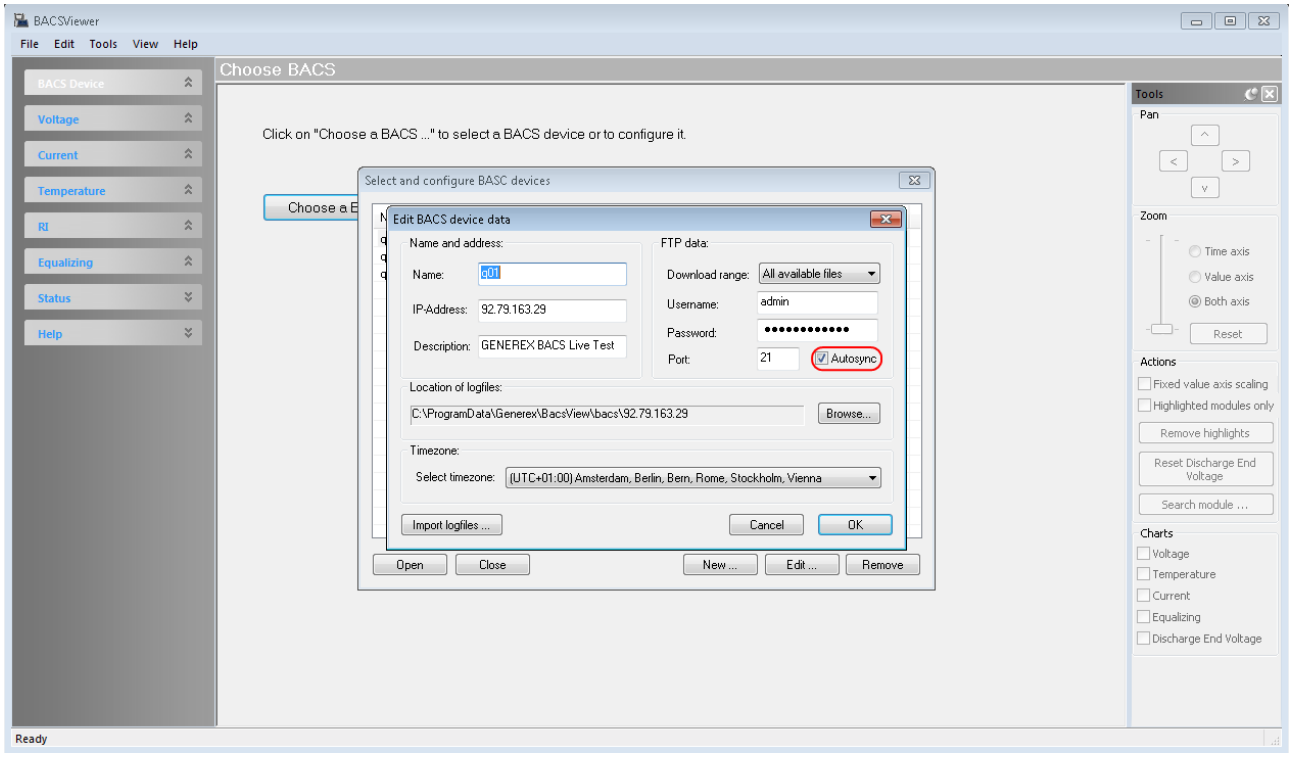

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Figure 40: Add BACS Device

The BACS Viewer version 4.1.0.0 provides the option to enable the “Autosync” mode. You can define under “Edit, Settings, FTP”, if the autosync should be executed during program start.

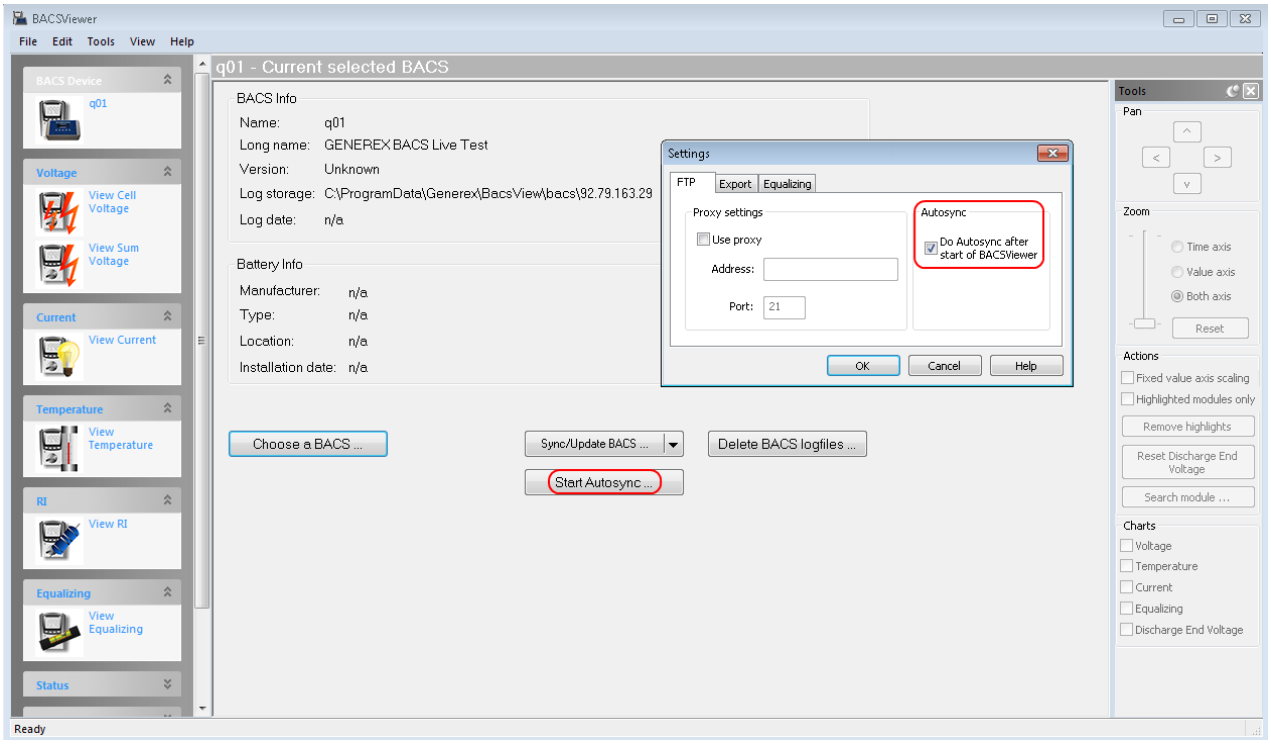

Figure 41: BACS Settings, FTP

The BACS-Info screen provides a button for the start of the Autosync manually.

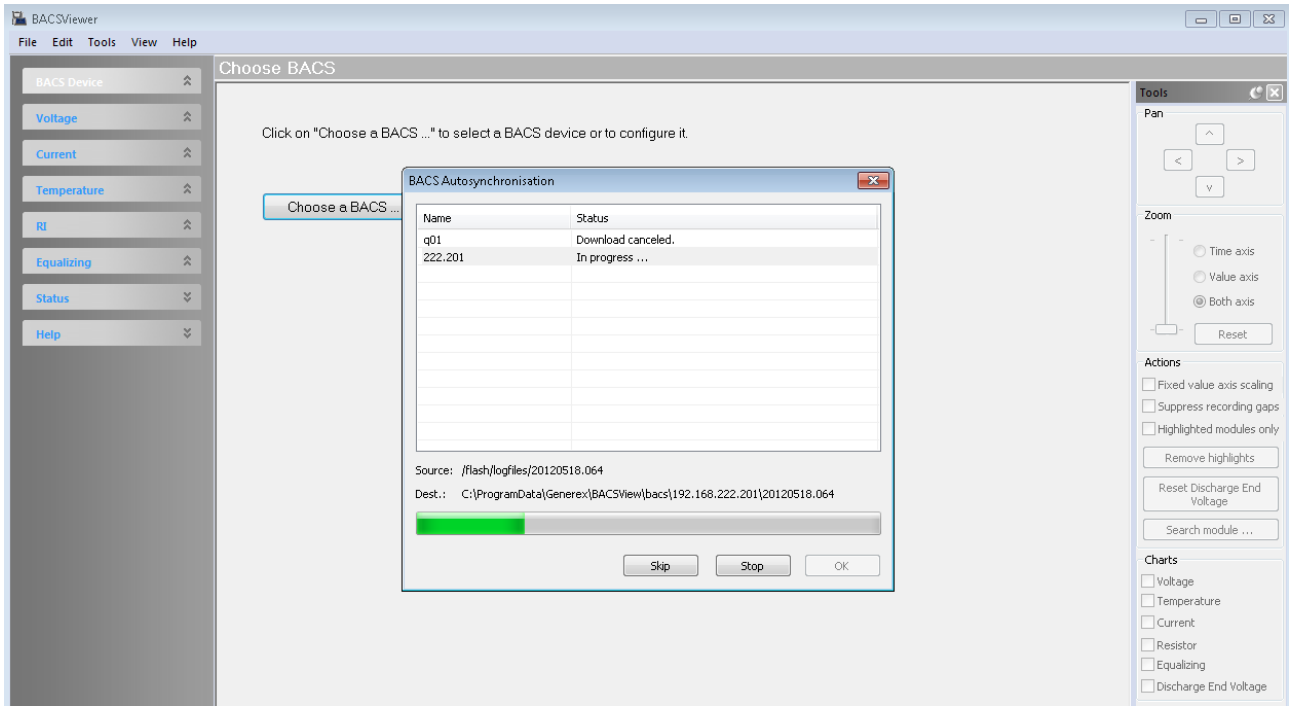

Figure 42: BACS Autosynchronization

The BACSViewer version 4.3.0.4 provides the feature to skip an already started autosynchronization process, if you do not want to synchronize the logfiles of this BACS Webmanager. Click the “Skip” button.

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You can see into the BACS device selection, if the Autosync was configured for the devices.

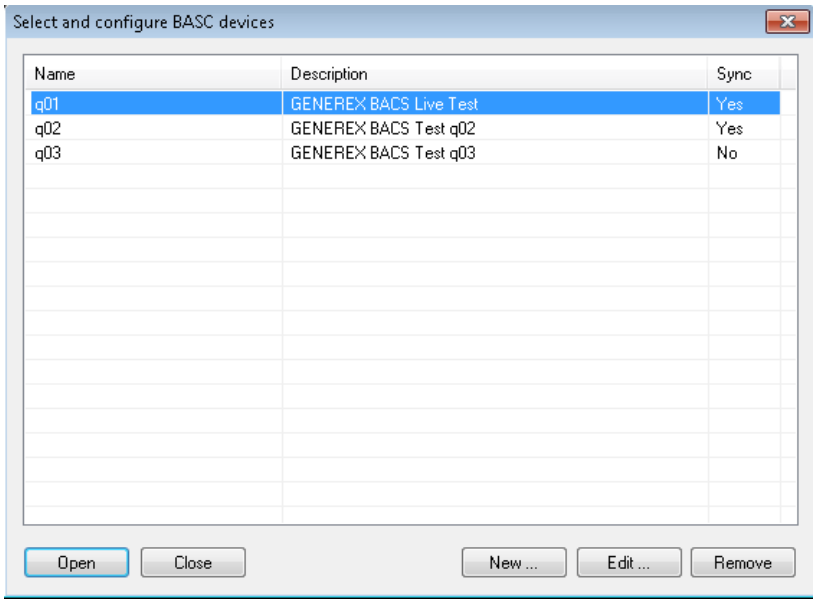

Figure 43: BACS Device Selection Autosync enabled

6.3 Synchronization of the BACS Data manually

Click the “Sync/Update BACS...” button. The data of your BACS device will be transferred via FTP.

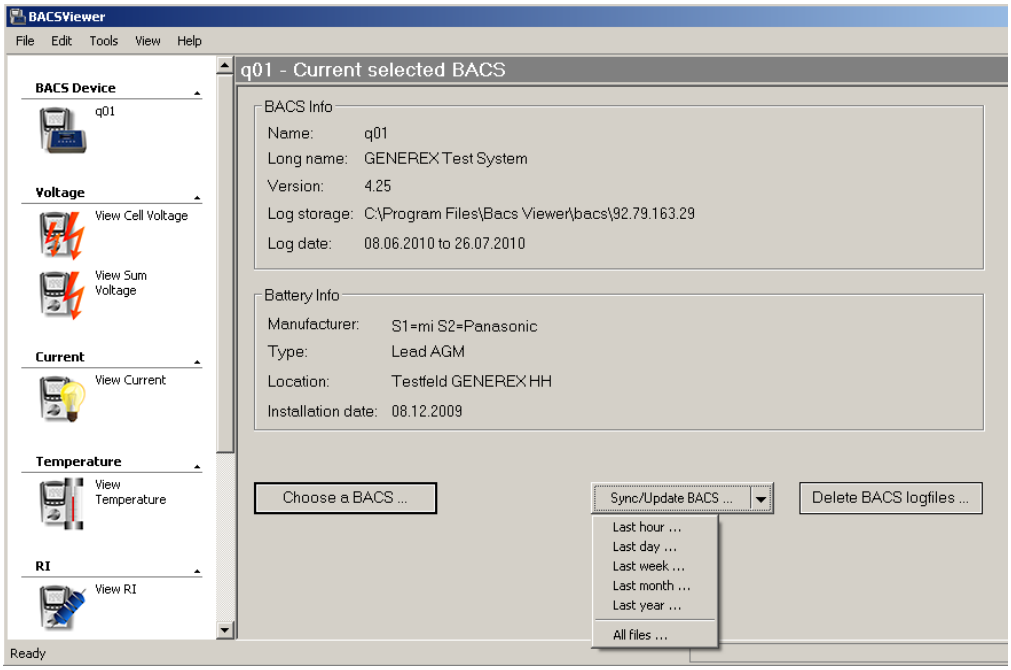

Figure 44: Synchronization of the BACS Data

Click the “Sync/Update BACS…” button if not already done before; the data will be transferred via FTP from your target BACS system.

The progress of the FTP transfer will be displayed.

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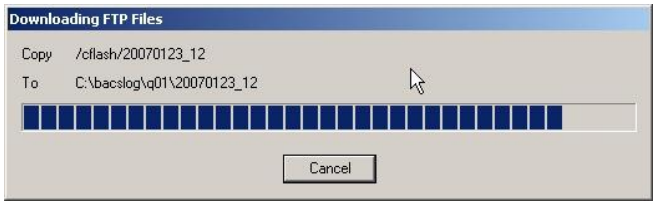

Alternatively you can import BACS data, e.g. from a USB stick or another medium. The easiest way is the synchronization via ftp connection to the BACS system you want to analyse.

During a synchronisation process you may limit the period of the download of the log files into the dropdown menu of the “Download range” is you are not interested in older data.

Please note that the BACS WEBMANAGER has a limited storage capacity. We recommend that you delete from time to time the older BACS data from the BACS WEBMANAGER. Depending on the quantity of batteries and number of alarms, the BACS system can store battery data for at least 3 months (at 256 batteries) up to several years if only a few batteries are monitored.

BACS VIEWER offers you all configurations it has found on your BACS system. If you find any unwanted configuration (e.g. 1 string, 1 module) please remove this configuration later from your BACS system and this BACS Viewer computer.

After the transmission is finished, you can start with the analysis of the data. Please take a look into chapter 6.6 for further information.

6.4 Deleting BACS data from BACS Webmanager and local Computer

You have the following options for the deleting of the log files via the “Delete BACS log files” button:

- “Delete files from BACS device” – Deleting of the files at the BACS Webmanager.
- “Delete files from local disk” – Deleting of the files at local hard disk.
- “Delete files of all configuration” – Deleting of the files of the entire configurations or rather the selected one.

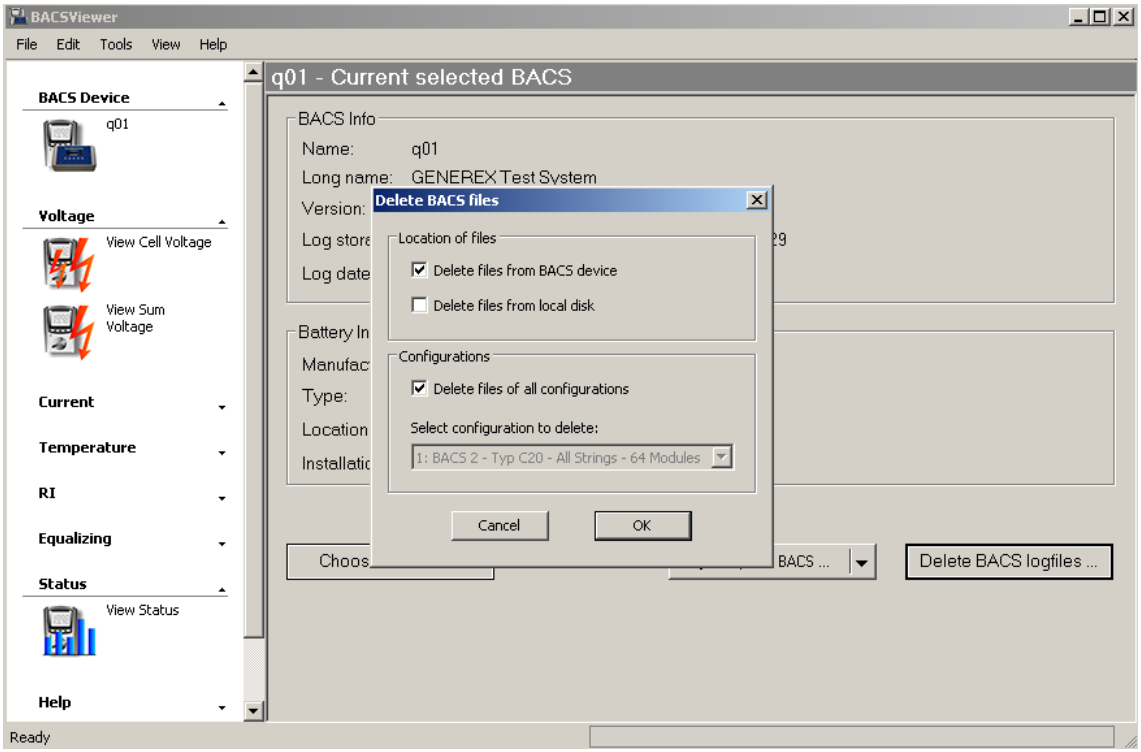

Figure 45: BACS “Delete BACS Files” Function

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6.5 Import BACS data

You can import files from the local hard disk or an USB stick via the “Import log files” button. Choose the accordant BACS system and click the “Edit” button.

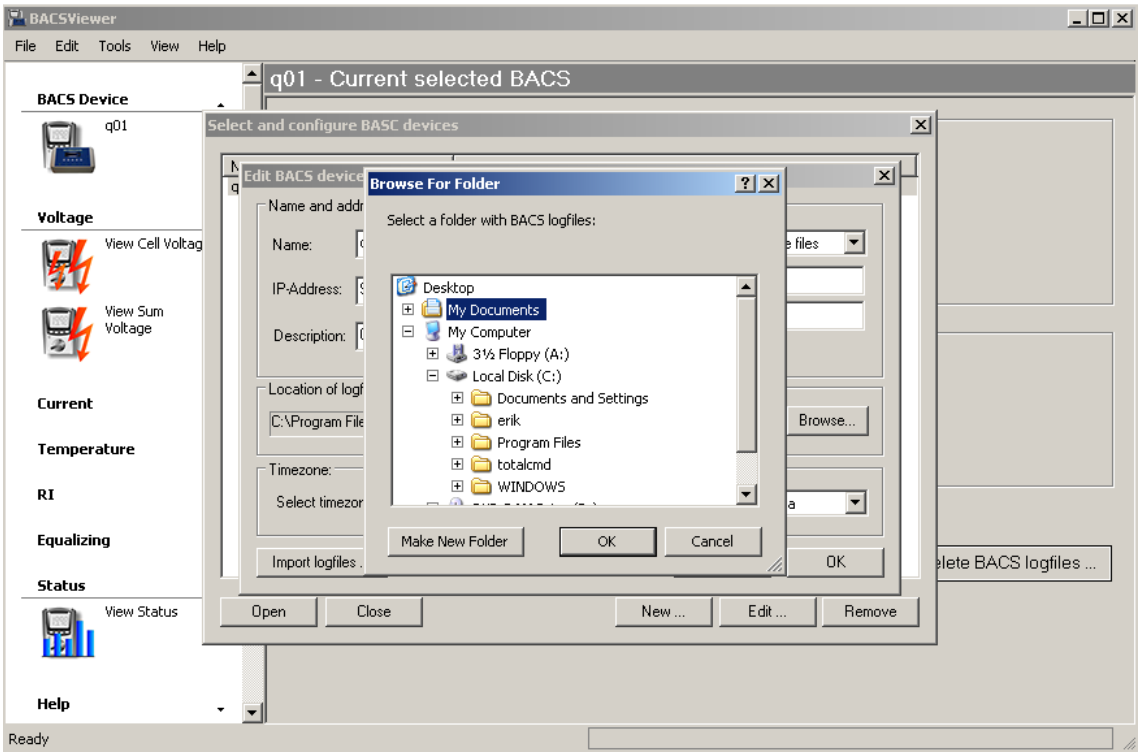

Figure 46: BACS Import of Files

Tip:
The transfer of the BACS log files into your local directory can be started automatically by a script command.
BACSView.exe –r <download_range_option> “<name of the device>”
This command will automatically download the latest BACS files to your local directory.
To link this command to your desktop, see the following screenshot

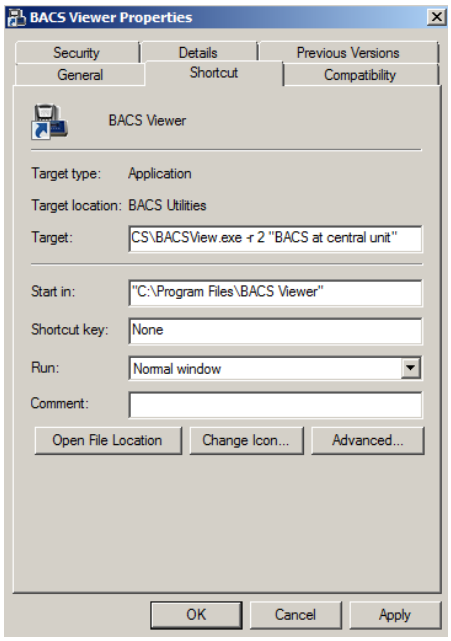

Figure 47: BACS Viewer script parameters for the automatic download

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6.6 Starting BACS data analysis

Using the example of the voltage analysis we describe in chapter 6 the usage of the tools (zoom in, zoom out, pan etc.).
After you have entered the network data of your first BACS system, click the « Choose a BACS… » button, to open the data on your local hard disk.

6.6.1 Voltage Analysis with the BACS Viewer

Start with the voltage analysis (View Cell Voltage), because failures are easy to detect here and discharges are simply visible. Afterwards we are describing the analysis of the impedance, temperature etc..
All described functions for the analysis of the voltages are present for the analysis of the temperature, current and internal resistance too.
Choose “All Strings” to see all battery data of all strings on one screen. For further investigations you may later choose only a special string number to reduce the amount of data displayed. “All Strings” is for a general survey of all data.

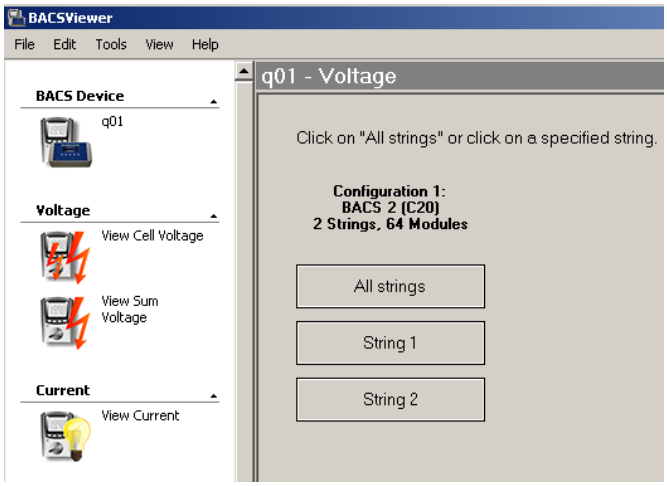

Figure 48: BACS String Selection

« View Cell Voltage » was selected. At “Show all values” you will see all available data on one screen. You can define a time range or display only time period. Click the “Show chart…” button for the graphical display to open.

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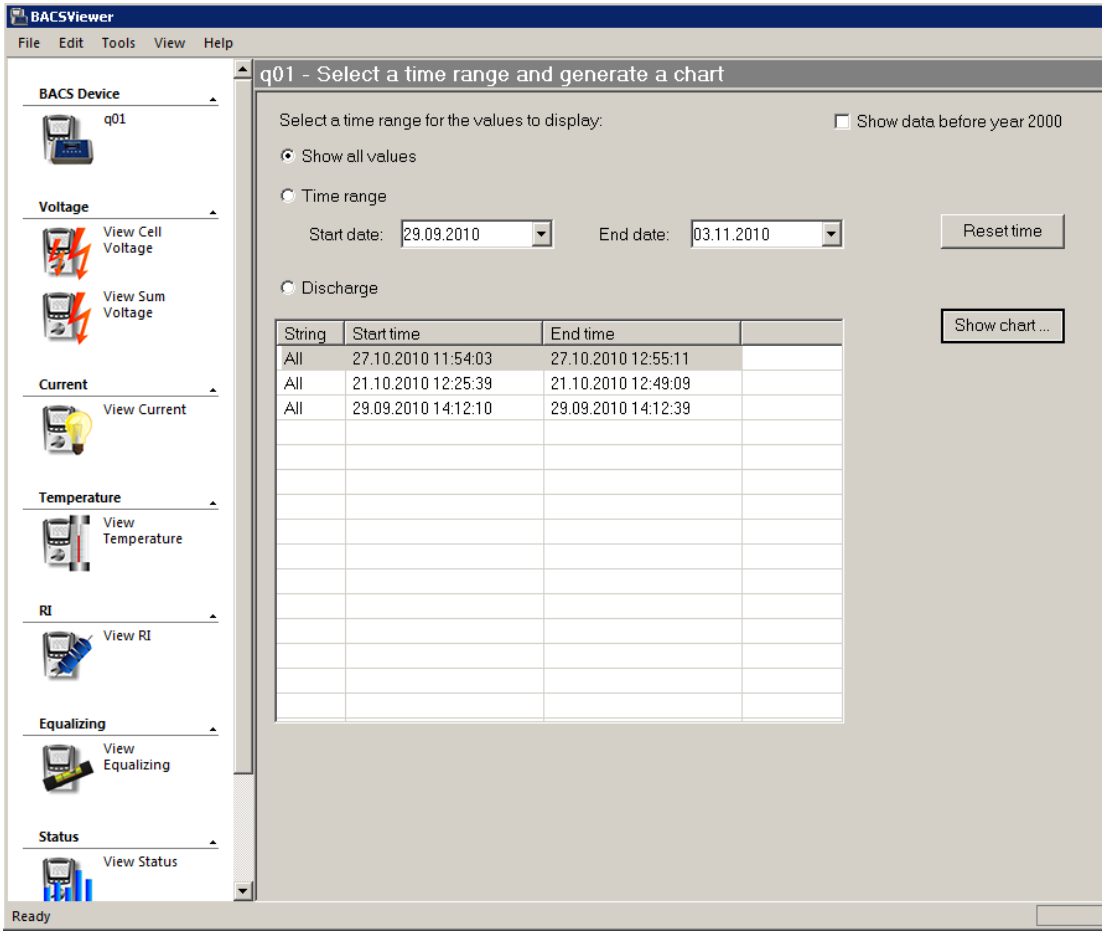

Figure 49: BACS Time Range Selection

NOTE: The function « Show data before year 2000 » is enabled by default. Any BACS data with timestamps before year 2000 will automatically not displayed. If you do not have set a timeserver in your BACS WEBMANAGER, than please disable this function to see BACS data before year 2000.

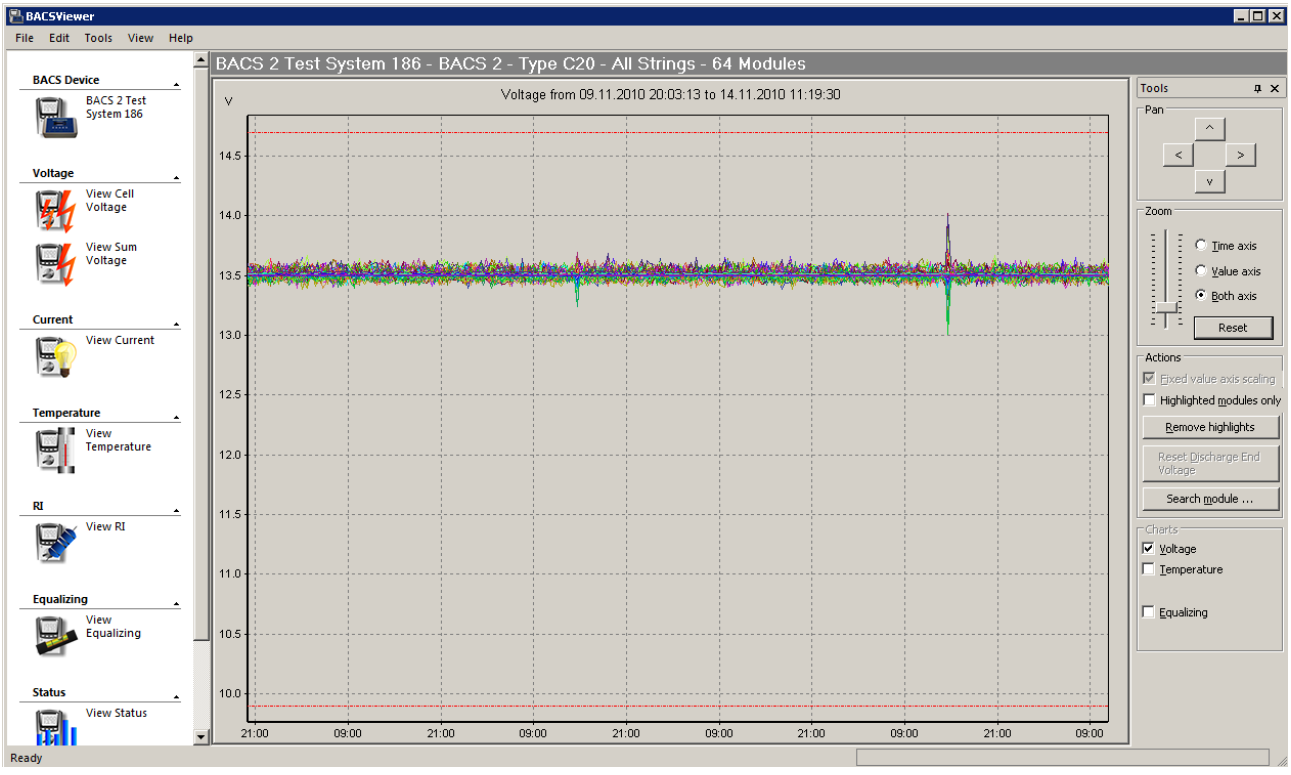

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Figure 50: BACS voltage analysis, showing alarm thresholds as red horizontal line

You can now see all battery voltages from the beginning of your timeframe and the alarm thresholds for voltage as horizontal red lines. You may now zoom inside or highlight batteries using the BACS Viewer functions as described further in this manual into chapter 6.6.2.

Discharge list

If the BACS viewer found discharges in the past, these will be display in the list “Discharge”. By clicking one of these discharges in the list, you are guided directly to an analysis of this discharge process. The BACS Viewer now shows a window of this discharge process from start until the power has returned.

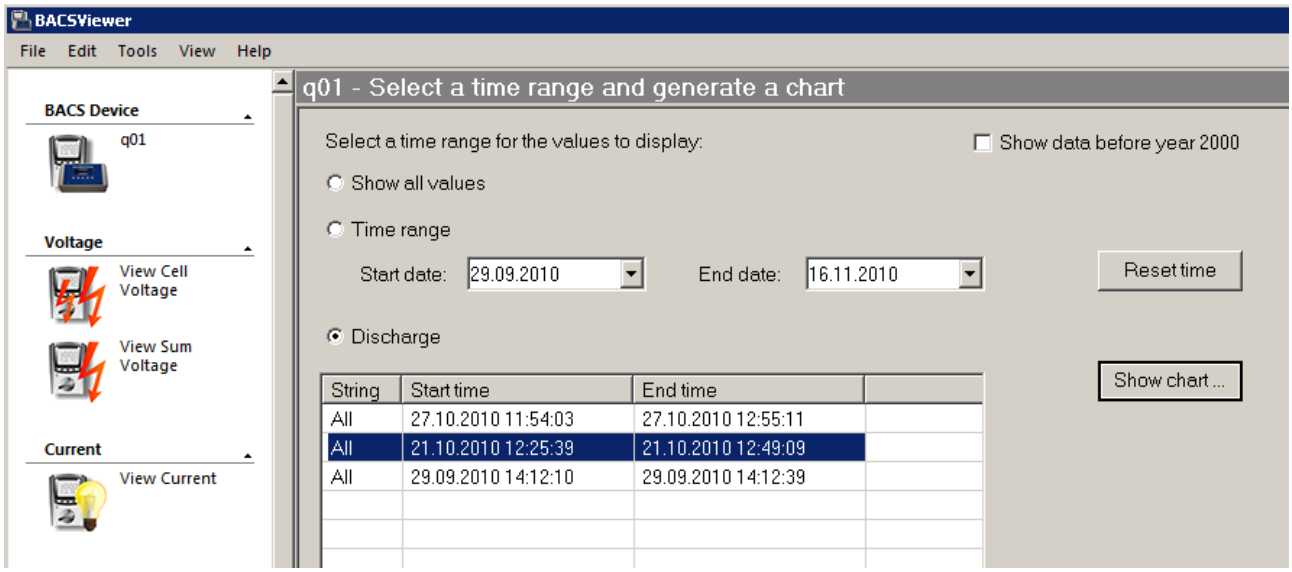

Figure 51: BACS Selection Discharge

In the following we show an example for such a “Discharge” analysis.

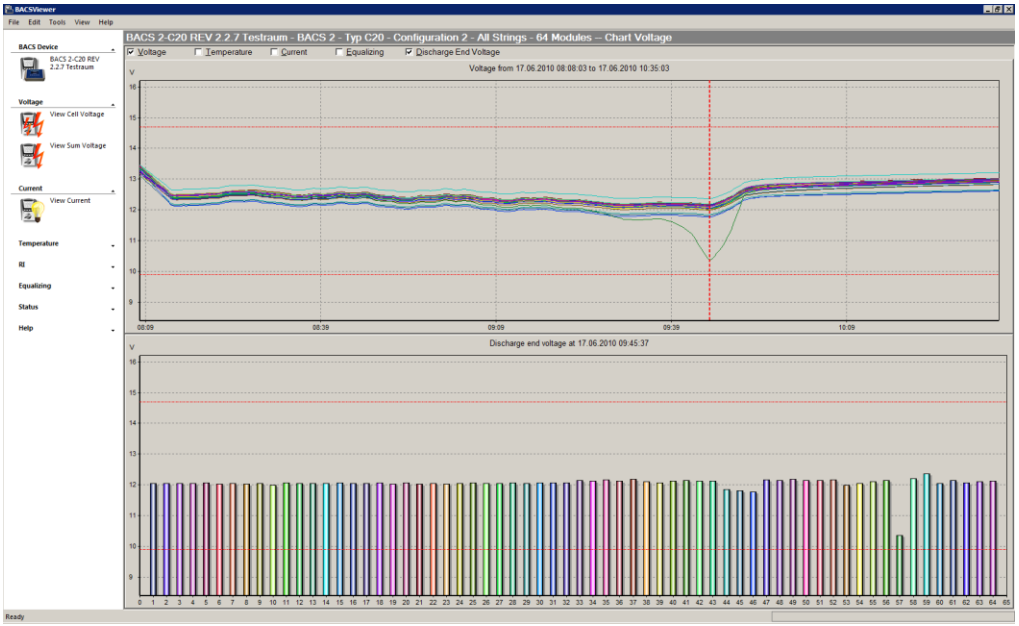

Figure 52: BACS deepest discharge point shown are vertical red dotted line

In the figure above you can see such a “Discharge” analysis. The upper window shows start and end of the discharge and the voltages of every single accumulator. At the vertical red dotted line the discharge has

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ended. In the lower window the discharge end (position of the vertical red dotted line) is shown as column for every accumulator. In this example you can see that accumulator no. 57 collapsed (compared to others), but could be correctly charged / recovered again through Equalisation later.

This analysis tells you to keep an eye on no. 57 and the neighbour accumulators at next discharge and the growth of impedance of this battery during the next 3-4 month has to be watched carefully.

In the “Discharge” window you may move the red dotted line to right or left with the mouse cursor, this shows you directly the individual accumulator voltages at the point where you have moved the line.

To reset the red dotted line back to the end of the discharge, click the “Reset Discharge End Voltage” button in the tools bar.

Like in any other BACS Window you can use the “Zoom” function for further analysis to find certain accumulator curves for “highlighting” or to “isolate” from others.

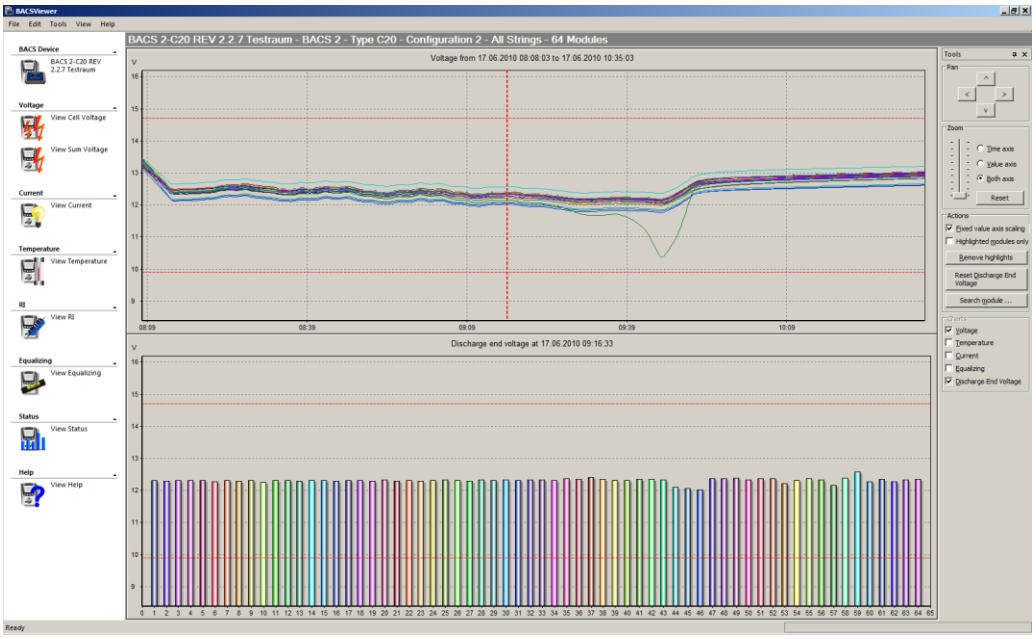

Figure 53: BACS dashed vertical red line shows the end of this discharge process and related voltages of every accumulator at this point

6.6.2 Tool “Zoom-In”

You can use a mouse or a keyboard to zoom in charts.

You have several choices to zoom in:

- A. Select the desired axis in the “Tools Bar” and move the zoom slider up to zoom the area in the center fo the BACS Viewer screen.
- B. Keep the “ALT” button and the left mouse button pressed and drag a box from left-top to right-bottom, to zoom into this area. For zooming further in you can also use the mouse wheel or simply drag another rectangle.
- C. Press the “ALT” button and left-click with your mouse into the area, which you want to zoom-in centered.
- D. Press the “PLUS” (+) button on your keyboard to zoom the centered area.

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6.6.3 Tool “Zoom-Out”

You can use a mouse or a keyboard to zoom out charts.

Execute one of the following steps:

- Select the desired axis into the “Tools Bar” and move the zoom slider down.
- Press the “ALT” and the “CTRL” button and left-click with your mouse into the area, which you want to zoom-out centered.
- Press the “MINUS” (-) button on your keyboard.

6.6.4 Tool “Reset Zoom”

Click the “Reset” button in the “Tools Bar” to bring the zoom level back to the initial and you can start a new analysis of the data again.

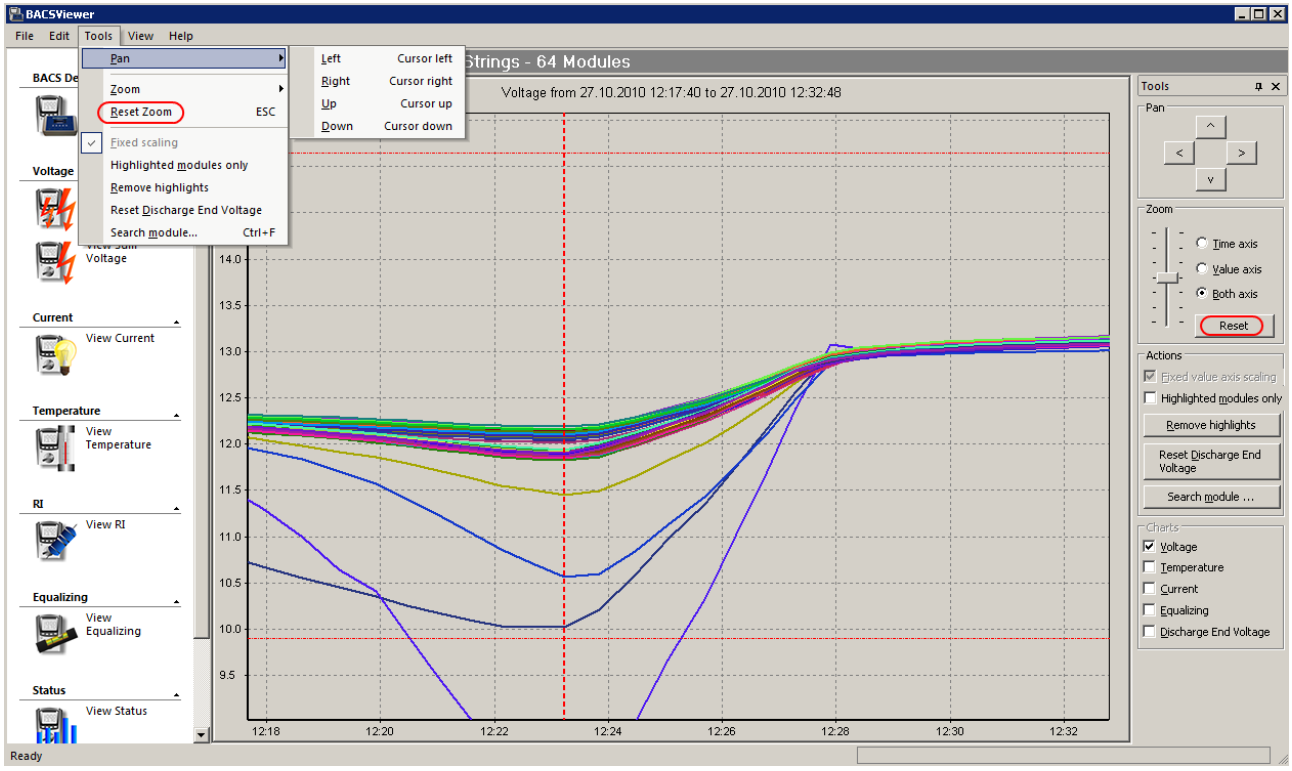

Figure 54: BACS Tool « Reset Zoom »

6.6.5 Tool “Pan”

You can use a mouse or a keyboard to pan the area within the chart. To move/pan the area in the chart, you have the following options:

- A. Click with the mouse button on one of the pan arrows into the “Tools Bar”, to pan the center of the picture into the desired position.
- B. Use the arrow keys on your keyboard.

6.6.6 Tool “Identify Accumulators”

To identify the battery accumulator in the curve you are analysing you have to zoom in until you can move the mouse cursor over the line and to the exact position which you want to see. Click the left mouse button,

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as long as you keep the mouse button pressed, the mouse cursor will show the accumulator number, date/time and measured value at the position on this curve.

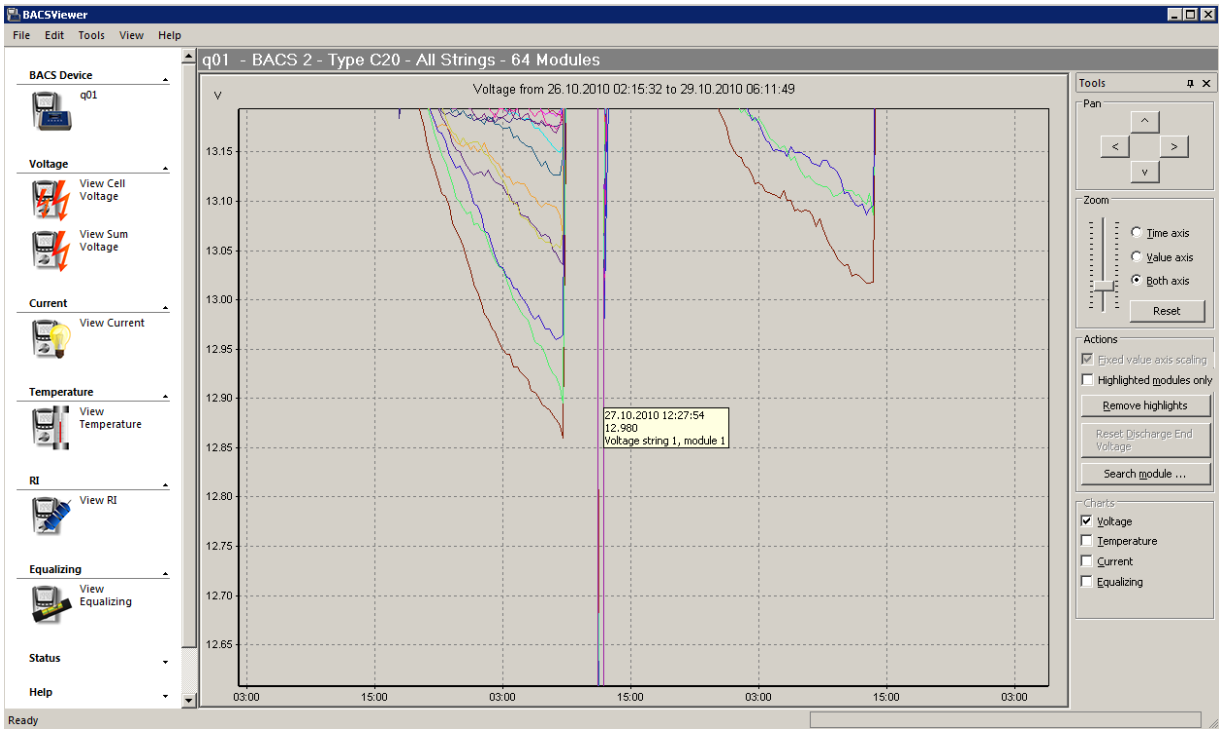

Figure 55: BACS coloured Module Identification

6.6.7 Tool “Suppress recording gaps”

The BACSViewer version 4.3.0.4 provides the feature to en- or rather disable the “Suppress recording gaps” function. Gaps can occur, if e. g. the BACS Webmanager is rebooting.

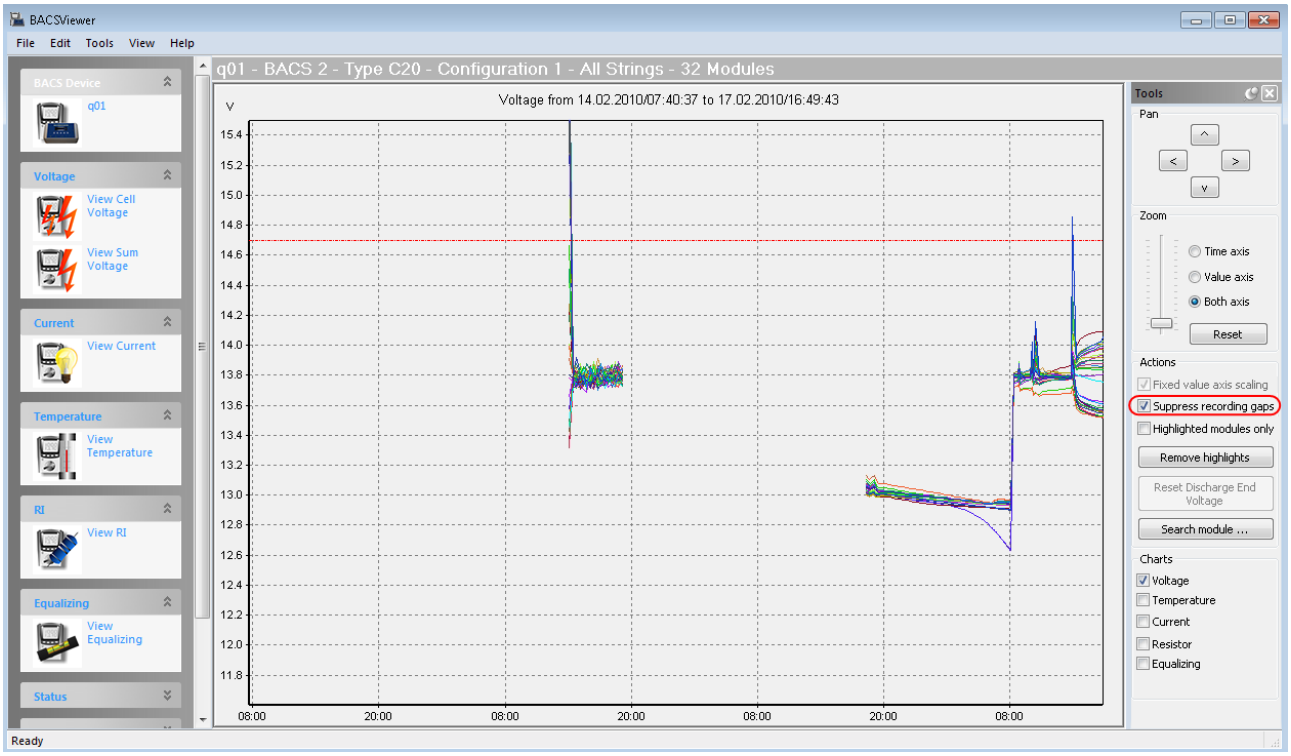

Figure 56: BACS Suppress Recording Gaps Feature enabled

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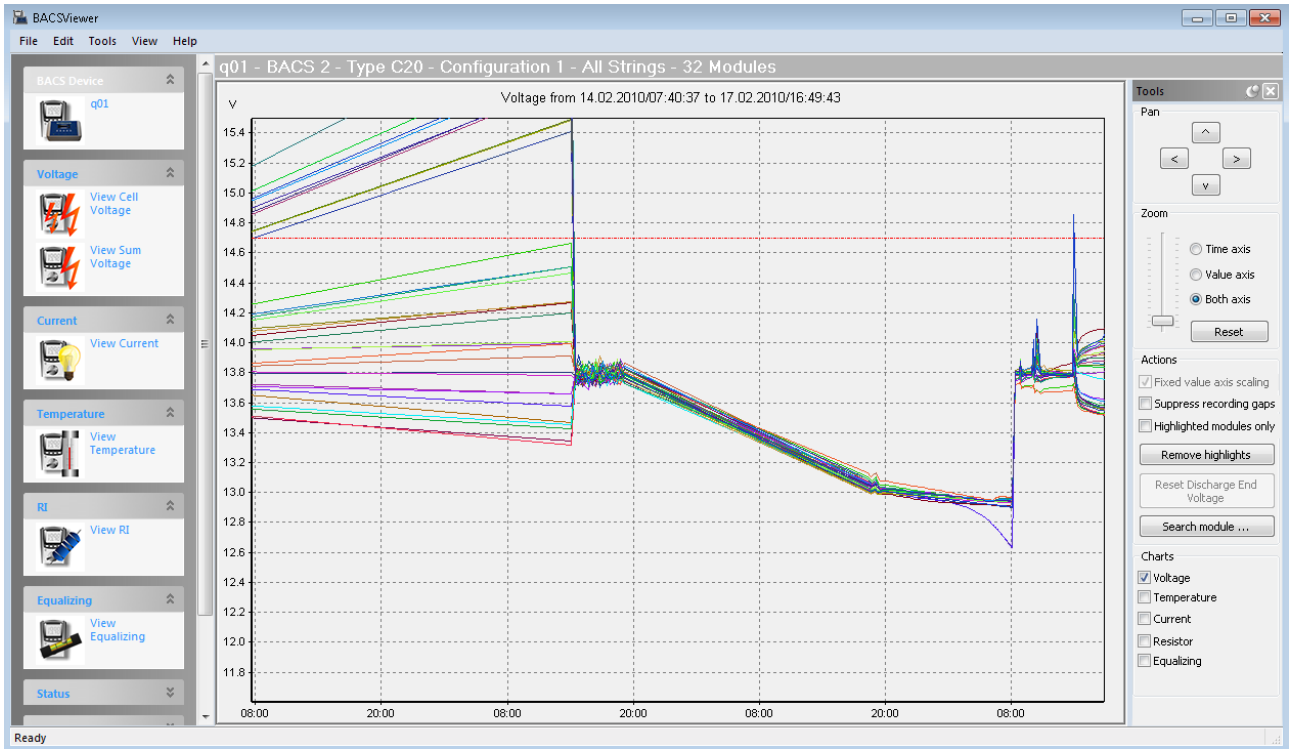

Figure 57: BACS Suppress Recording Gaps Feature disabled

6.6.8 Tool “Highlight Accumulators”

You can highlight the curve of a certain accumulator, if you select the desired one and mark it as “bold”. Highlighting allows you now to see the behaviour of this accumulator compared to other accumulators within the group. Keep the “SHIFT” button pressed and click on a single line/curve at the same time, to highlight or rather mark it in terms of colour.

A highlighted accumulator shows itself as a bold curve/line now, while the others remain at normal size. See into the figure below the highlighted accumulator as bold blue line.

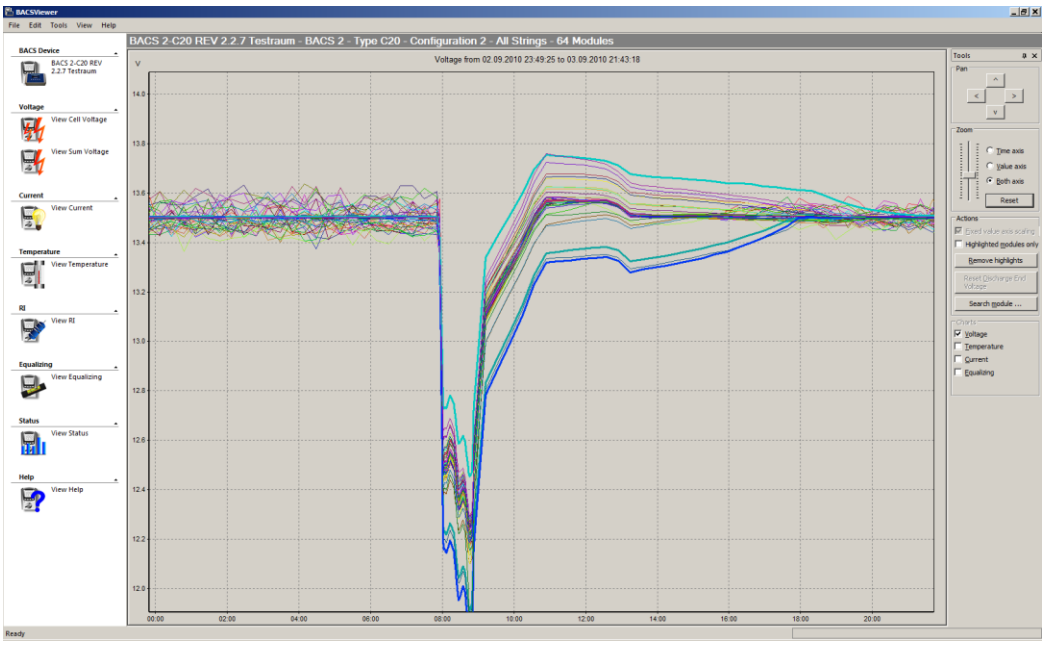
BACSViewer
BACS 2-C20 REV 2.2.7 Testraum - BACS 2 - Type C20 - Configuration 2 - All Strings - 64 Modules
Voltage from 02.09.2010 23:49:25 to 03.09.2010 21:43:18
Ready

Figure 58: BACS “Highlight” Function

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6.6.9 Tool “Isolate Accumulators”

You can isolate accumulators in all charts, to be able to see only highlighted accumulators. After you have highlighted the desired accumulator enable the „Highlighted modules only” function into the “Tools Bar”. Now all other accumulator curves are hidden and you see only this accumulator.

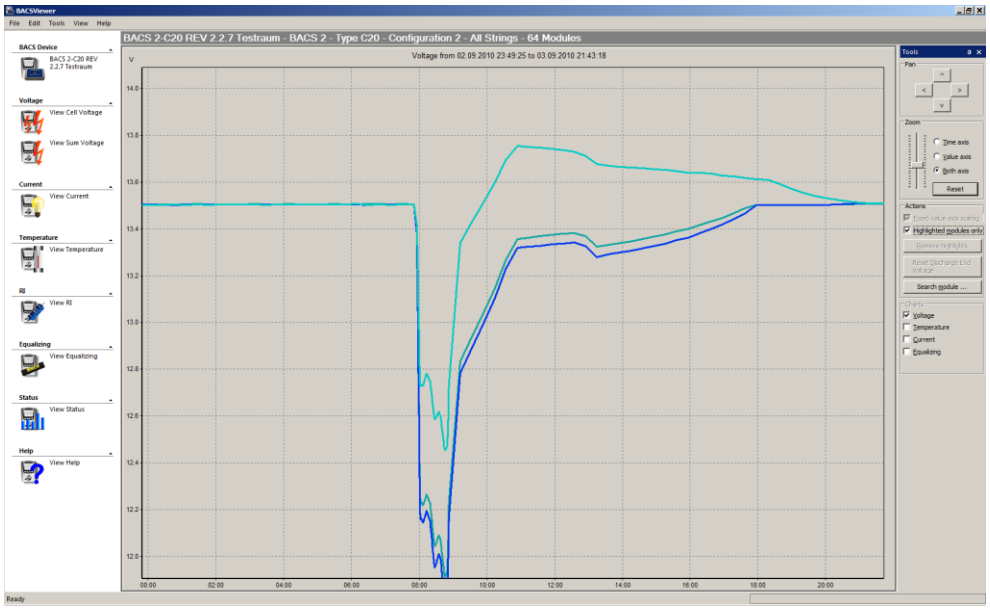
BACS 2-C20 REV 2.2.7 Testraum - BACS 2 - Type C20 - Configuration 2 - All Strings - 64 Modules
Voltage from 02.09.2010 23:49:25 to 03.09.2010 21:43:18
Tools
Highlighted modules only

Figure 59: BACS “Isolate” function, hiding all other accumulator lines

All “Tool Bar” or other functions which were described above for the analysis of the voltages, are identical for the analysis of the BACS current, BACS temperature, BACS Equalisation and BASC impedance analysis.

6.7 Current Analysis (optional BACS_CS Current Sensor required)

Current analysis is identical to the procedure used for voltage or other values analyse, but it’s an optional sensor that provides such data. So you may not find these values in your BACS data, unless you have installed the BACS_CS Sensors (optional). If a Current BACS CS Sensor is installed you can see the value of the Amperes that are taken from this battery string during discharge and how much is taken in – during the following charging process.

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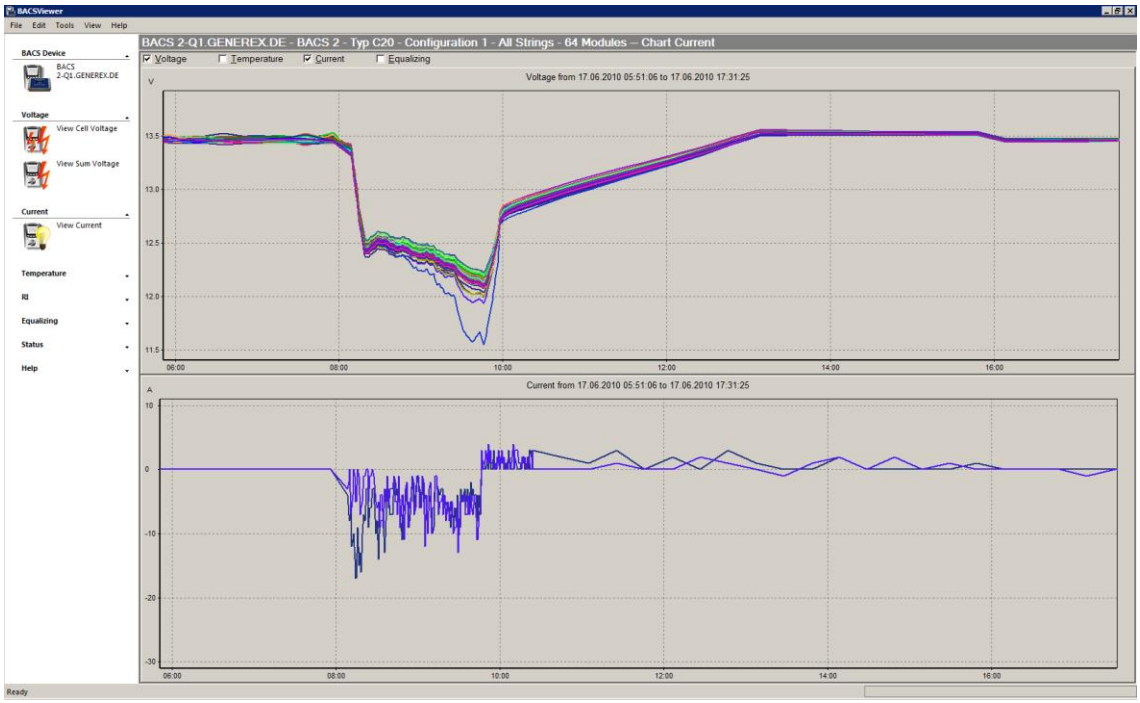

Figure 60: Current curve of string 1 and 2 during discharge/charge

In the graphic above you can see a discharge and charge process, in the upper window you can see how the voltages falls and then rises back during the recharge, in the low window you can see the current in Ampere during this process. During the discharge the accumulators in string 1 and 2 show a max. Current of - 15A, in the charge phase only up to + 4A, getting less by the time the accumulators reach their full charge level. Negative values show a discharge and a positive value show a charge process. The discharge and charge of both strings should be almost identical. If any string shows a far higher current during discharge than the parallel string, then this is a signal that there may be a problem in one of the strings present. In this example you can see that the discharge in string 2 is higher than in string 1, this is an effect which comes from different accumulator types and qualities in these 2 strings, which is suboptimal.

6.8 Temperature Analysis with the BACS Viewer

Temperature analysis is identical to the procedure used for voltage or other BACS values. Since every BACS module has a temperature sensor on board, you can very precisely see how much accumulator temperature rises during a discharge and following charging process. A rise of temperature of + 10° to + 40° may be regarded as “normal” at a discharge process under high load, but after the accumulators have been fully recharged the temperature should be back at the normal level, before the discharge began.

Watch out if you receive temperature alarm emails or messages! If accumulators get corrupted, they signalize this in a constant increasing heat of the accumulator. So if any battery show constantly a rise in its temperature, check immediately if the measurement is correct – and if so, be alarmed if this accumulator temperature rises significantly faster and higher than other accumulators within the group. This maybe a signal that a “thermal runaway” could happen on this battery, which requires immediate action.

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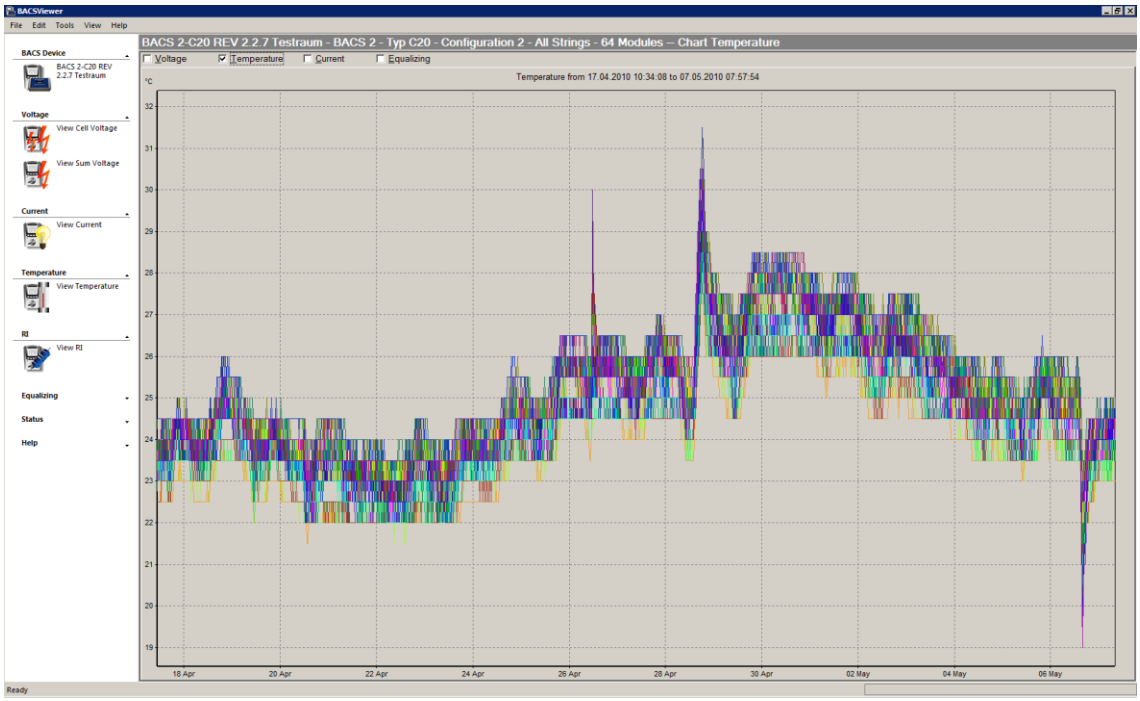

Figure 61: Battery temperature rise and fall due to environmental influence or discharges

In the picture above you can see that the battery temperature goes up and down due to the outside temperature (day/night temperature change). Peaks in temperature may come from discharges/charges, but as long as after the temperature goes down again within 8-10 hours after discharge, the effect of the outside temperature is visible, not any battery thermal problem.

Since outside temperature may change drastically in a battery room or cabinet, you should set the alarm levels accordingly. Only if the battery temperature increases steadily, over 40 ° and more, than you have to react immediately because this indicates a thermal runaway.

ATTENTION: Observe the accumulator temperature up to 12 hours after discharging ! Ongoing at discharging « thermal runways » could occur directly, massive increase of the temperature at damaged accumulators, which could lead to a fire. The danger of a battery break down and damage of the system is very high up to 12 hours after discharging. Afterwards a battery group can be seen stable and can be integrated into the normal alerting. Until then be careful and react immediately by cut-off of the charger, if the accumulator temperature increase instead of being constant or rather decrease after the discharging. Also if no noticeable problems were visible into the voltage during discharging, it can mean anyhow, that the accumulators can be alter in a short time and may show a massive increase of the temperature, which could lead to a fire! The critical time here is between 3 to 12 hours after discharging. If the temperature has been decreased, then it will not change within short. Otherwise react immediately and switch off the charger!

Besides watching extreme temperatures during discharge/charge, you can also see in which environmental conditions these accumulators have operated in general. If accumulators are constantly kept in rooms with more than 25°Celsius, than you have to expect a drastically reduction of the total battery life, unrewarded if BACS is installed or not. BACS may extend the lifetime of such batteries, but the higher the temperature of the battery room is, the less the BACS Equalisation can show a positive effect on the lifespan of the accumulators. Try to keep accumulators cool you will gain the most out of the BACS management functionality.

Advice: Batteries are classified by the manufacturers in service life. Therefor the « EUROBAT » standard is used in Europe. Thus accumulators with « Eurobat 12+ » are designed for 12 years and more. In addition the manufacturers declare the exact date, e. g. 15 years. All details are valid at 20°C. If the temperature is 10°C higher, the corrosion will boost massive and the value has to be cut in half, that means of the 15 years remain 7,5 years of prospective service life only. At 40°C the service life would be less than 4 years and at 50°C only 6 months. For this reason it is important to monitor the temperature of the accumulators, to induce an earlier exchange at steady high temperatures.

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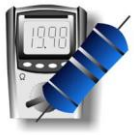
Advice: It is required, that the charging voltage has to be changed, per degree Celsius temperature increase or rather decrease of the value of 20°C, to reach the stated lifespan of the accumulators from the manufacturer. Generally lead-based accumulators take effect, an increase of 0,03V per degree Kelvin (-272,15°C) has to be effected, if the temperature change. Example: An accumulator was stated with a sustainment charging of 13,52V at 20°C. If the environment temperature is 25°C now, that means, that this is a decrease of the charging voltage of 0,15V.



6.9 RI Impedance Analysis with the BACS Viewer

“RI” means Resistance Impedance and is showing the BACS data for electrical resistance, also called impedance.

Impedance is indicating in long terms of an accumulator if a replacement is necessary or not. It is the only relevant data which will give you a feedback about the accumulator health during charging/float charging phase or no load. Battery voltage is not a measurement for identifying weak accumulators as long as the charge is running or no load is applied. Unfortunately this is exactly the situation you find in any UPS or other battery operated appliance – the accumulators are under maintenance charge and do not carry any load – without discharging the accumulators at a high load you cannot distinguish good accumulators from bad ones. But such a discharge always has the risk that these bad accumulator fail – and the system collapses in seconds, or even worse – the system showed correct voltages during the discharge while being watched, but in the following charging phase these accumulators which survived the discharge are now defect and will cause a collapse of the system the next time.

The only way to find out if an accumulator is good or bad during a float charge is measuring its impedance in a “secure” voltage windows and over a long period of time. “Secure” has to be understood that the voltages and temperatures of all batteries in the string should be as close as possible to allow a comparison. The Equalizing/Balancing feature of BACS secures that the voltages are harmonized and impedance can be compared.

Impedance increase is a normal process of any accumulator over the time and is an indicator for the aging of accumulators. Rising impedance is also an indicator for loss of active material, short circuits across the plates, corrosion on the positive grid, dry-out and sulphation. So through impedance history you can see many accumulator problems although the charge is active and without the risk to make the system collapse. A fast rise of impedance warns you also for the following problems beside those mentioned above, like thermal runaway. Additionally the Impedance is a quality index for the accumulator within your group. If all accumulators come from the same source and having the same production date and quality, than they should not differ very much regarding impedance. In the picture below you can see that these accumulators differ considerably, most are at 20 mOhm, but there are several with 30 and more, increasing much faster than the others. This is an indication for several defect accumulators within this system, although the battery voltage did not show any problems.

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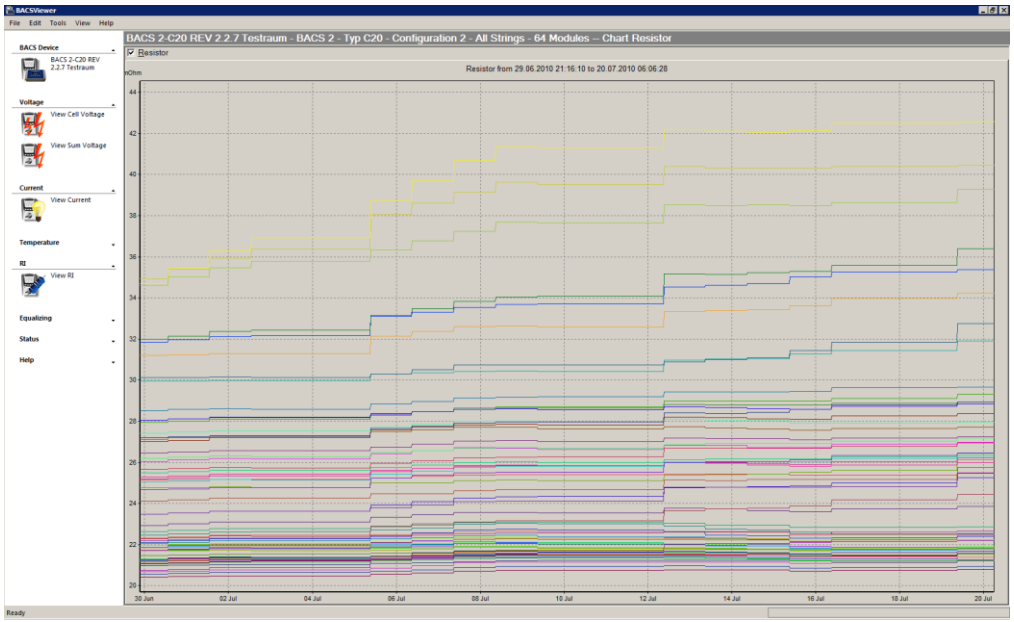

Figure 62: Increase of impedance showing aging of batteries and defects

Generally the overall Impedance of your accumulators should not increase more than 5% per year, if you keep it in a controlled climate and with an ideal charger. If temperature is not stable, many discharges or false charging operations occurred, than this increase will be faster and your battery life will be shortened.

Generally the impedance curve in BACS should show an almost horizontal line, so you should not see any major change for 90% of the battery life – unless there is a problem.

In the picture above you can see that accumulators which are OK do not show any significant increase, while others do have this effect, and rise faster than the others.

The absolutely measuring value (numeric value) RI in milliohm does not describe the state of an accumulator directly. Because the manufacturers of the accumulators are measuring the RI with different measuring devices, the values are comparable only, if identical measuring devices were used and the environmental data (temperature, accumulator voltage) were the same. Since this is almost never the case, the absolutely measuring values in milliohm, which are determined from BACS, are not always comparable with the data from the manufacturer. Exception: The HIOKI measuring device “Battery Hightester” model 3554 determines almost identical measuring results at correct handling like BACS, but these models only. Other HIOKI models determine other absolutely measuring values, but proportional to the BACS values identical.

The difference of the RI measuring within the accumulators is more important as the absolutely measuring value. The tighter the measuring values match (e. g. all accumulators got a measuring value +/- 10%), the better the state. The farther the accumulators are apart and the more this difference is increasing, the worse is the state of the accumulators, which got more worse proportional to the initial value at the start-up.

Basic rule for VRLA batteries: An increase of the RI during normal operation from the start (baseline) within less than 30% is tolerable. More than this is critical and change of the battery should be considered.

Example: The majority of an accumulator group is between an area of 3,5 and 6,5 milliohm. At exceeding of 8,45 milliohm (6,5 milliohm + 30%) of an accumulator, an alarm level should be set, to check this accumulator.

Basic rule for flooded Cells OpZs batteries: An increase of the RI during normal operation from the start (baseline) within less than 20% is tolerable. More than this is critical and change of the battery should be considered.

Basic rule for NiCd batteries: An increase of the RI during normal operation from the start (baseline) within less than 50% is tolerable. More than this is critical and change of the battery should be considered.

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Advice: The first RI measuring starts earliest 15 minutes after reboot. The delay is implemented to avoid false measurings, because of not yet harmonized voltages. 2nd, 3rd and 4th measuring takes place 15 minutes later, after 60 minutes the system will measure impedance only once per 24 hours.

6.9.1 RI Impedance Analysis with the BACS Viewer Baseline

The BACS Viewer version 4.2.0.0 provides the Baseline function for the support of the impedance analysis. This function displays the change of every accumulator since the start of the measurings (limited through the selected time range). The following figure displays an optimal RI baseline, with a difference of just +1,5% increase.

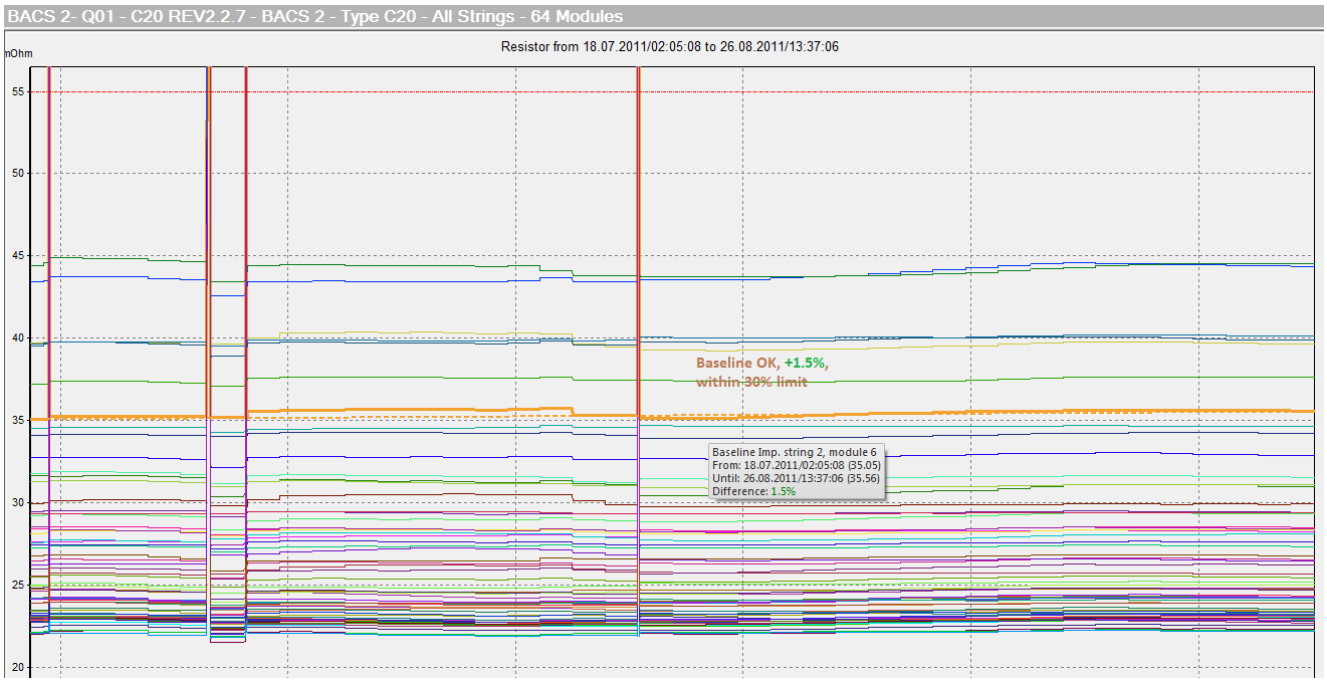

Figure 63: Impedance Baseline with small change

The following figure displays the baseline (dotted line) where the green battery RI has increased +11,6% and is now withing the warning area (10% to 30%).

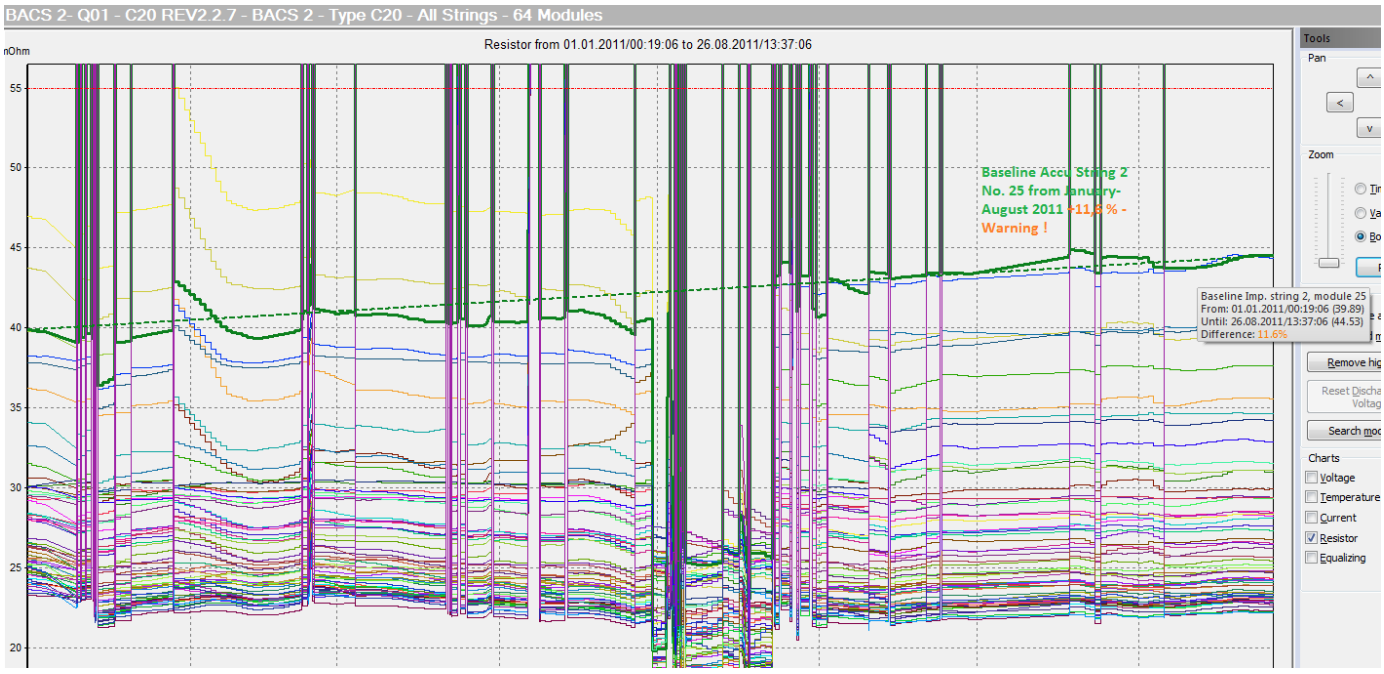

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Figure 64: Impedance Baseline with course into warning area

The next figure displays a baseline with a difference of +95,7%. This is abnormal and may indicate, that a wrong measuring was made within the selected time range. Please select a shorter time range for the analysis and see if now a reasonable value is found and compare this with other batteries in the same time frame.

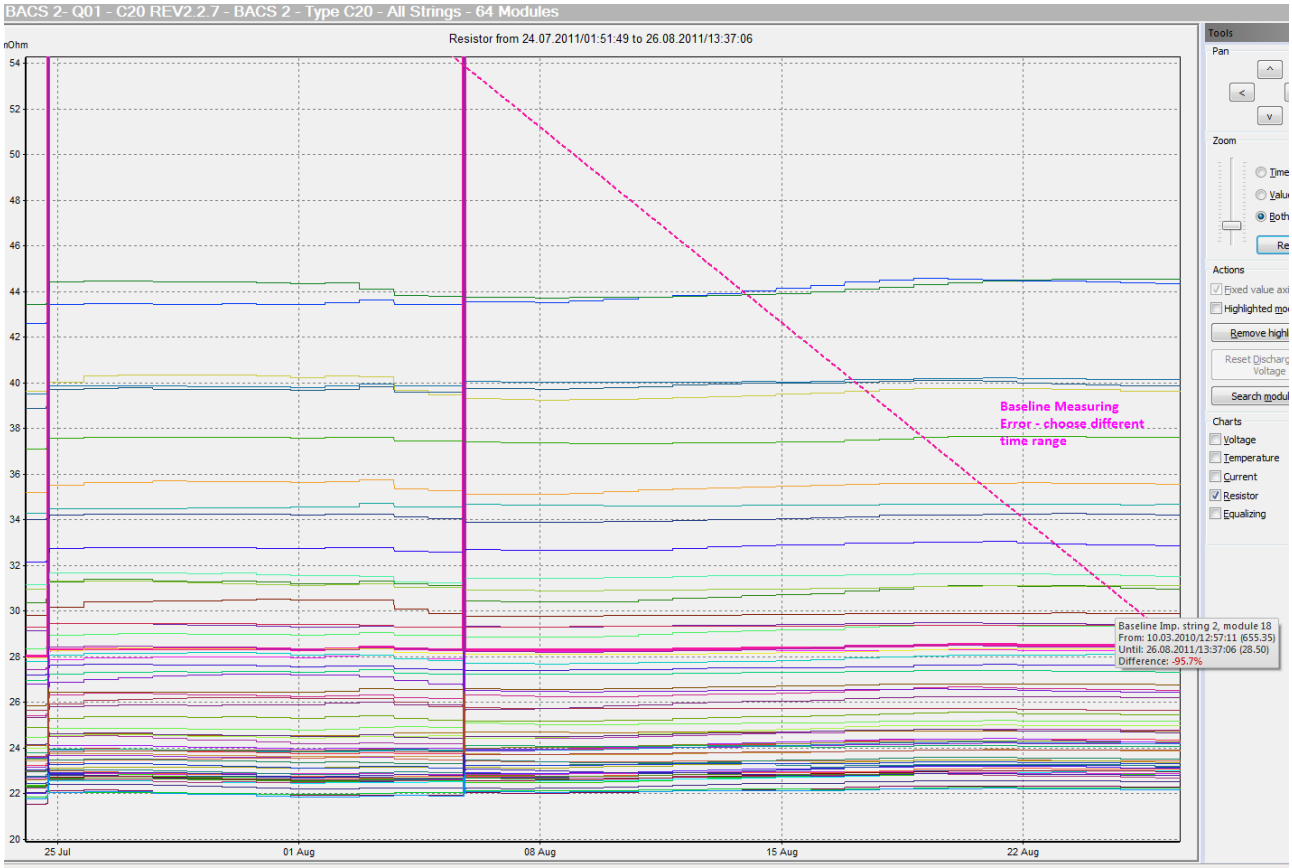

Figure 65: Impedance Baseline with Measuring Error

6.10 BACS Equalisation Voltage Analysis

This graph shows you the Equalisation power per battery during charge process.

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Figure 66: BACS Equalisation Chart, showing the effect of Equalisation on accumulator No. 59, avoiding overcharge.

Equalisation is a GENEREX patented “care” function to avoid damage to accumulators through over or under charging.
The level and the duration of the Equalisation power is display via the BACS Viewer as shown in Fig. 51. A system that only requires the Equalisation process for just a short time period is a good system or a well-balanced system. That means that the accumulators are not drifting very much and should be in a good shape.

How Equalisation works: Figure 51: You can see how the Equalisation process works with this example. The light blue battery curve, marked with red arrows above, shows that this battery wants to rise over 13,5 V. The figure below displays the Equalisation current on this battery of 100% as long as this battery receives too much charging voltage. BACS module connected to this accumulator tries to prevent this risk for overcharging with full performance. At 5 p.m. the other batteries have now increased their own voltage level and are now also fully charged, so that the Equalisation current of the light blue battery can be reduced. At midnight the light blue battery requires just a small amount of Equalisation current and now behaviours like the other accumulators. Here you can see how the Equalisation process protected this accumulator from being overcharged for 12 hours.

If the Equalisation process continues for a long time then the BACS system will counter steer constantly against the battery charger to avoid overcharge or undercharge of certain accumulators. This is a “normal” process and very common the more accumulators that are formed into a group. The more accumulators that are in a group, the more the probability to have several accumulators outside the voltage level which is not “ideal” and require extra charge or discharge. If such accumulators are not equalised, they would drift away and may get damaged by sulphation (undercharge) or dry out (overcharge). This problem is eliminated by the BACS patented Equalisation and the graphic above shows the results of this “repair work” on every accumulator.

Equalisation is only active during the charging phase, e.g. at 12 Volt accumulators starting beyond 13.2 Volt. BACS starts at 12 Volt batteries with its treatment only if some batteries do not follow the charging levels like the majority of other accumulators.

Equalisation is set “active” as default in a BACS system. The better the accumulators are, the less the amount of Equalisation power to keep them in the optimal capacity.

Permanent Equalisation: Equalisation is an automated process, controlled by the BACS WEBMANAGER. Although this it is normal that the more accumulators that are in a group, the more Equalisation power is required, it should be kept in mind that a constant “counter steering” of BACS may also show a general problem with the charger or one or more accumulators which BACS will not overcome and additional maintenance action should be taken.
Such a problem may be the so-called “permanent Equalisation”- this is a system where all accumulators show constantly a high Equalisation power (almost all acumulators > 80% Equalisation for more than 2-3

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weeks). If Equalisation is constantly counter steering, it may be a that a defect accumulator is within this group which cause such a malfunction of the charger. Please check the charger or do a discharge of the batteries to see if there are any acumulators which collapse earlier than others or show high impedance. If such batteries are found, please remove these from the system as soon as possible to lower the Equalisation power and avoid a permanent Equalisation over 80%.

BACS supplies always a minimal Equalisation, even if all batteries are perfect. So in the Equalisation Status at the Web browser you may see a grey icon, which indicates that actually the Equalisation power is less than 50%. Any Equalisation over 50% will be displayed as green so make the “care” process visible. Ideal would be that all batteries do not need more than 50% Equalisation, but the more accumulators you have in a group, the more you have to tolerate that Equalisation is necessary.

7. Other Menues in the BACS VIEWER

7.1 Menu *FILE*

Print
In the Menu FILE you can setup your printer to print your analysis reports to a local printer.

7.2 Menu EDIT/Settings

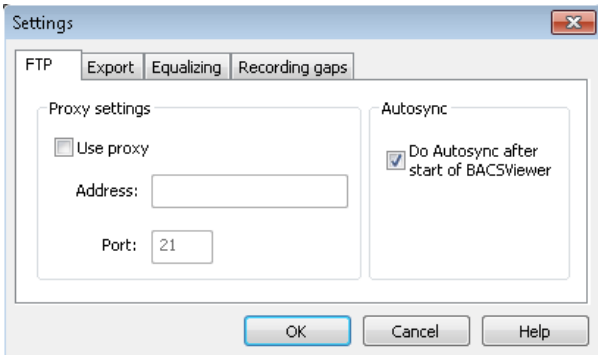

Figure 67: BACS Viewer Menu Edit/Settings

7.3 Menu FTP

If you want to use a proxy server, you can define its parameter in the “FTP” page.

7.4 Menu EXPORT

If you want to store the data as CSV file on your hard disk, to be able to import the data into an external program, just use “Export”. The export function will create a CSV file which consists of all values for this time range (temperature, impedance, temperature, Equalisation power and current.)

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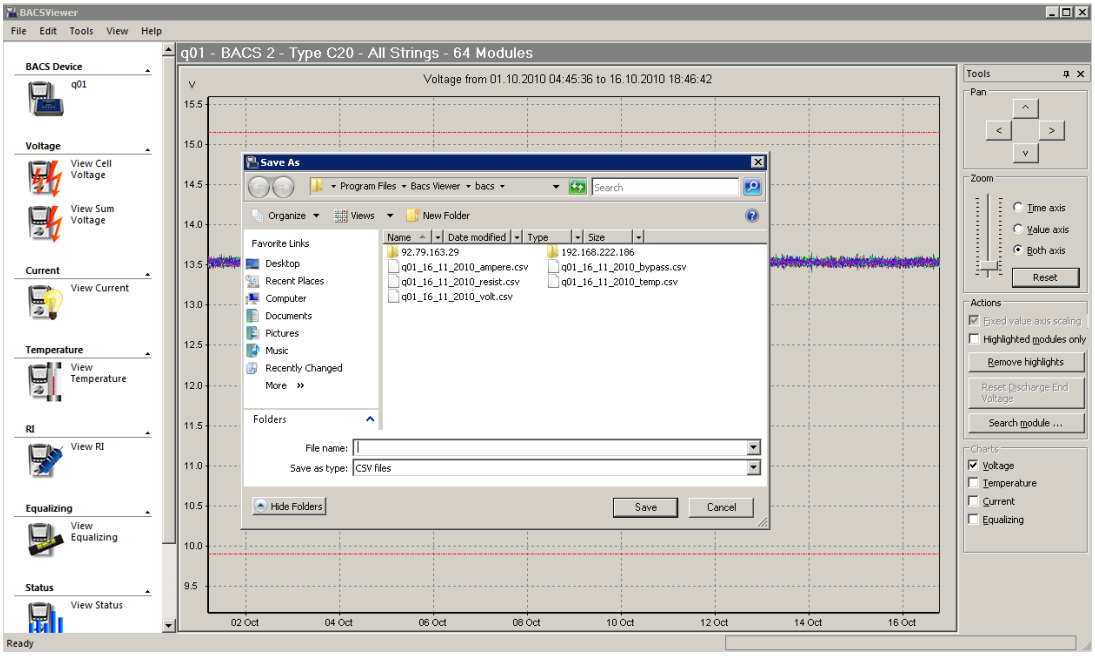

Figure 68: BACS “Export” Function to CSV file format

7.5 Menu Equalisation

Because the behaviour of every single accumulator is different, dependent of the battery capacity (other measuring of the internal resistance and limitation of the Equalisation current), it is easier for the operator, if the BACS Viewer internally corrects these adjustments automatically to make accumulator installations of different capacities comparable. If you enable the “scale Equalisation values” (default is on) than the BACS Viewer shows in the screen “Equalisation” all values relative. So e.g. If you have a small battery where the BACS module limits itself its Equalisation power, the BACS viewer shows up to 100%, identical to the display of the Web browser interface. If you disable “scale Equalisation values” than the BACS Viewer shows the absolute value. This will show now that a BACS module provides only 20% of its Equalisation power at small capacity accumulators. Example: At 7A batteries you will see at “ON” up to 100% Equalisation power, at “OFF” you see the real value, the limitation of max. 20% of the available Equalisation power only.

This makes the comparison with other accumulator capacities easier since you have not to consider caring about the different amounts of Equalisation power anymore, the BACS Viewer always shows you the systems identically if you keep “scale Equalisation” on.

7.6 Menu Recording Gaps

The BACSViewer version 4.3.0.4 provides the feature to en- or rather disable the “Suppress recording gaps” function. Gaps can occur, if e. g. the BACS Webmanager is rebooting.
NOTE: The function « Show data before year 2000 » is disabled by default. Any BACS data with timestamps before year 2000 will automatically not displayed. If you do not have set a timeserver in your BACS WEBMANAGER, than please enable this function to see BACS data before year 2000.

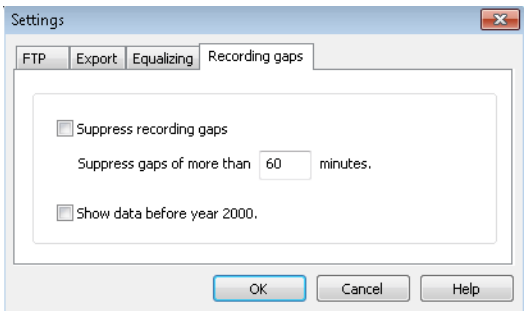

Figure 69: BACS Recording Gaps

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7.7 Menu View

Automatic scaling of X and Y axis. You can scale the ordinate with the “Fixed Scaling” function (default is on). If this function is enabled, BACS VIEWER will display automatically only BACS values between the configured limits of alarms.
If no limits are found in your BACS data, then the display may be “empty”. To get your data visible, please disable this function.

If you disable this function, all available BACS data are displayed and you have to use the ZOOM in function manually for scaling.

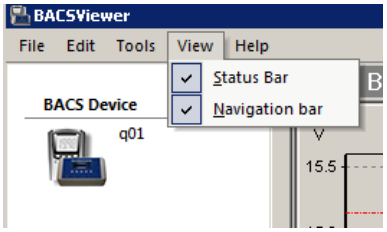
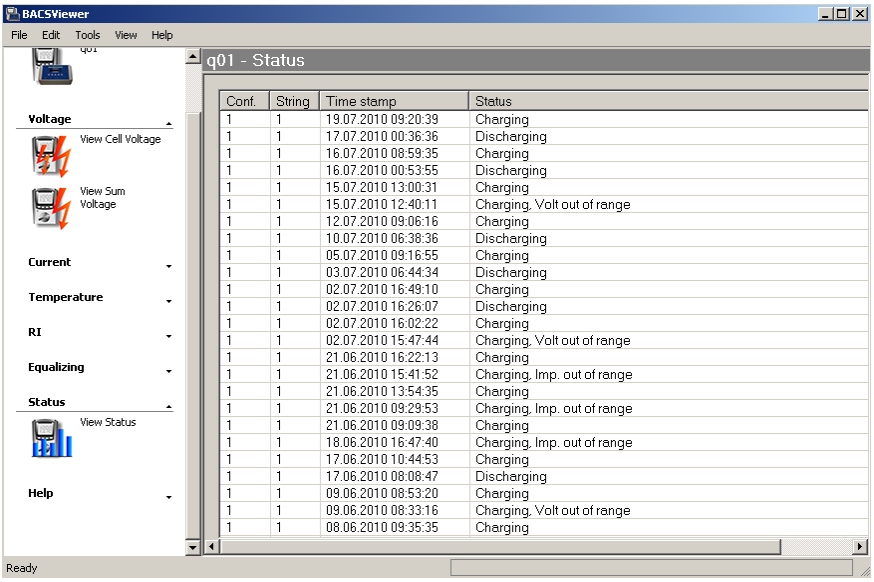


Figure 70: BACS “Fixed Scaling” Function on/off

8. BACS Status

You can review the most recent actions or alarms in the STATUS windows. All alarms are shown as text entry with the timestamp of its occurrence.



Conf.	String	Time stamp	Status
1	1	19.07.2010 09:20:39	Charging
1	1	17.07.2010 00:36:36	Discharging
1	1	16.07.2010 08:59:35	Charging
1	1	16.07.2010 00:53:55	Discharging
1	1	15.07.2010 13:00:31	Charging
1	1	15.07.2010 12:40:11	Charging, Volt out of range
1	1	12.07.2010 09:06:16	Charging
1	1	10.07.2010 06:38:36	Discharging
1	1	05.07.2010 09:16:55	Charging
1	1	03.07.2010 06:44:34	Discharging
1	1	02.07.2010 16:49:10	Charging
1	1	02.07.2010 16:26:07	Discharging
1	1	02.07.2010 16:02:22	Charging
1	1	02.07.2010 15:47:44	Charging, Volt out of range
1	1	21.06.2010 16:22:13	Charging
1	1	21.06.2010 15:41:52	Charging, Imp. out of range
1	1	21.06.2010 13:54:35	Charging
1	1	21.06.2010 09:29:53	Charging, Imp. out of range
1	1	21.06.2010 09:09:38	Charging
1	1	18.06.2010 16:47:40	Charging, Imp. out of range
1	1	17.06.2010 10:44:53	Charging
1	1	17.06.2010 08:08:47	Discharging
1	1	09.06.2010 08:53:20	Charging
1	1	09.06.2010 08:33:16	Charging, Volt out of range
1	1	08.06.2010 09:35:35	Charging

Figure 71: BACS “View Status” Overview page showing all events and alarms on this system

9. BACS® Accessories

9.1 BACS® BUS CONVERTER II

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Figure 72: BACS BUS CONVERTER II

This is the BACS CONVERTER II model, built from 2007 to 2008. Input Power range 9-18V, min. 800mA. Default power supply is 12V 800mA for installations up to 160 BACS modules. For larger installations please provide a power supply with 1.5A.

The power supply should not be shared with other devices to avoid false measuring. Please avoid using a switching power supply type, transformer type to direct supply from a Battery would be ideal.

DBSUB 9 Port: BACS CONVERTER offers a DSUB 9 service port to work with the BACS PROGRAMMER Software (for Windows). The PC cable is not included, please use a 1:1 standard RS232 cable, see layout below.

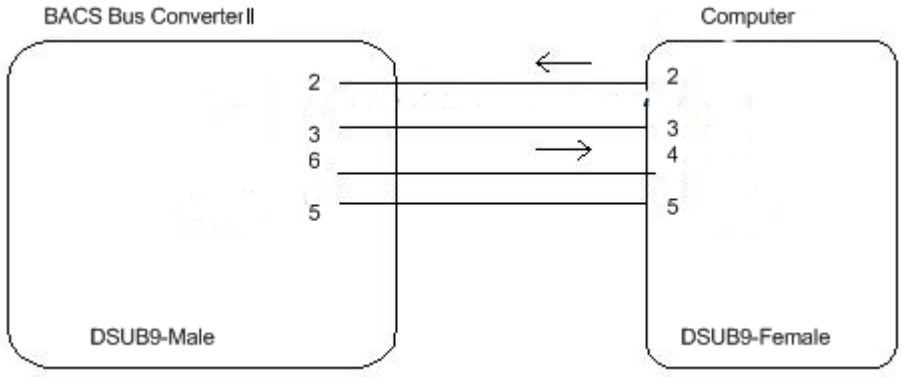

Figure 73: PIN Layout CS121 Config-Cable to Windows PC with BACS Programmer Software

Attention! This service port is only functional, if the BACS WEBMANAGER COM3 is not connected!

9.2 BACS® BUS CONVERTER III

Figure 74: BACS BUS CONVERTER III

This is the BACS CONVERTER III model built from 2009. Input Power range 12-18V, min. 800mA. Default power supply is 12V 800mA for installations up to 200 BACS modules. For larger installations please provide a power supply with 1.5A. The BACS CONVERTER III “Plus” has additionally an internal RTC real-time clock on board as a backup timeserver. If no timeserver is available into your network environment, you can manually set the system time. Click the “timeserver” button into the BACS WEBMANAGER Configuration menu and enter the desired parameter.

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Figure 75: Set System Time manually

The power supply should not be shared with other devices to avoid false measuring. Please avoid using a switching power supply type, transformer type to direct supply from a Battery would be ideal.

This BACS Bus Converter 3 provides 2 inputs for the BACS bus cables to create a ring from the first to the last module. Through this the cable length can be shorter and the power supply of the standard power supply supplies not up to 200 modules.

Mini 8 Port: BACS CONVERTER offers a Mini 8 service port to work with the BACS PROGRAMMER Software (for Windows). The Original BACS / CS121 Configuration cable requires and adapter before it can be used with this service port. This adapter can be ordered separately, or you may design such an adapter yourself.

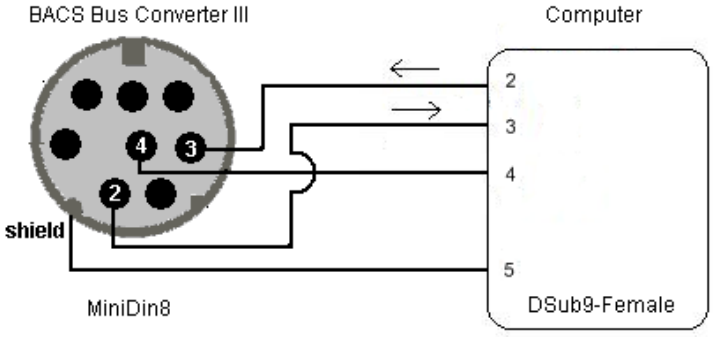

Figure 76: PIN Layout CS121 Config-Cable to Windows PC with BACS Programmer Software

Attention! This service port is only functional, if the BACS WEBMANAGER COM3 is not connected!

9.3 BACS® SPLITTING BOX

Figure 77: BACS SPLITTING BOX

The BACS SPLITTING BOX is a passive splitter for BACS communication cable and can be used for the optimization of the cable lengths and for the creation of an optical pleasant wiring. In addition to the extension of the 2 BACS bus inputs at the BACS CONVERTER for e.g. the bonding of BACS DC Current Sensors. We recommend to use the BACS SPLITTING BOX, if you want to connect more than 50 BACS modules into the BACS bus.

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9.4 BACS® CSxxx Current Sensors

Figure 78: BACS_CS300 and BACS_CS_500 DC current sensor

Description & Functions:
The BACS_CSxxx Current Sensor is a measuring unit for the integration into the BACS II bus system. This unit provides the measuring of the string current into the negative or rather positive range of a battery circuit and displays the data in Ampere.
The active measuring value will be displayed via the web-interface, the BACS II Webmanager showing the „BACS Status“ of the string (*Fig.62*). The measuring values will be stored sequentially in the history files and this data can then be used later for system analyze and performance interpretation by using the BACS Viewer software.

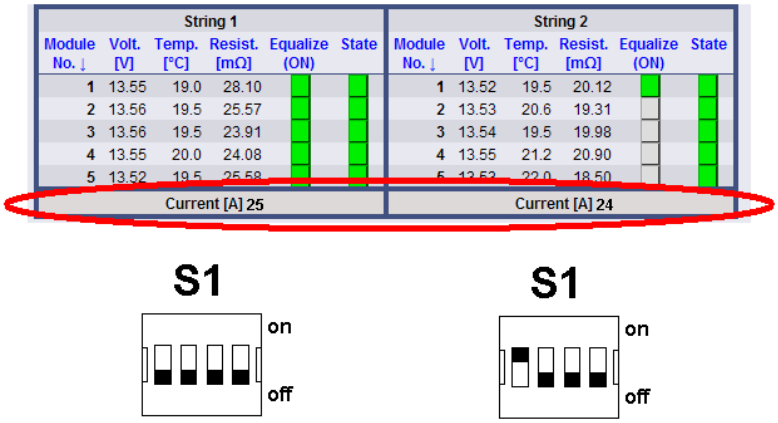
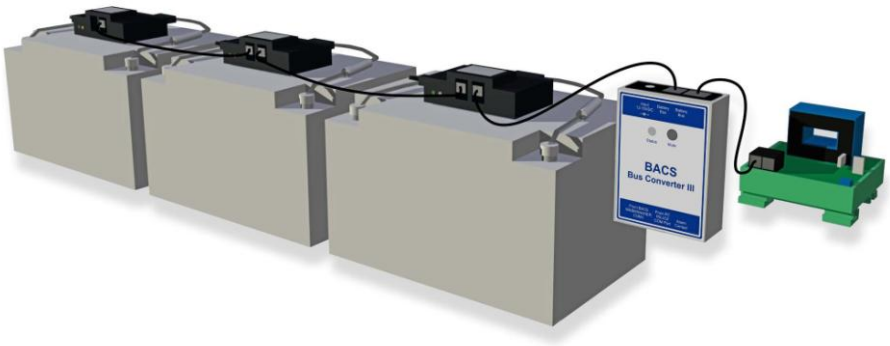


Figure 79: BACS_CSxxx

Assembling:
The BACS_CSxxx Current Sensor is designed for DIN Rail mounting

Bus Connection:
The BCAS CSxxx sensors (one or more units) should be connected to the BACS CONVERTER via a separate communication bus cable. Do not mix a BACS_CSxxx Current Sensor into the same communication bus string where BACS Modules are connected.

Connect the „X1“-RJ10 socket of the BACS_CSxxx Current Sensor with any BACS bus-cable to the „battery bus“of the BACS CONVERTER or rather an input of the BACS SPLITTBOX. Please reserve one of the 2 Inputs “battery bus” at the BACS CONVERTER or if occupied, at the BACS SPLITTBOX for the BACS Current sensor bus to avoid conflicts with the BACS C modules and to get a clear signal at longer cable lenghts. You can connect up to 8 BACS_CSxxx Current Sensors on this bus. Use the « X2 » for the connection to the next BACS_CSxxx Current Sensor.



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Battery Circuit Connection:
Put the cable of the battery circuit you want to measure through the transducer „W1“ on the BACS CSxxx Current Sensor. Check to make sure the cable is place in the unit in the correct direction to measure the flow of current (see marking of the BACS_CSxxx Current Sensor, *Fig. 63*)!

Addressing:
The BACS_CSxxx Current Sensor can be addressed via the DIP-Switch „S1“. The string number and the address will be defined via the switch setting of the switches. The measuring value will be displayed below the string number (see *Fig. 2*). The BACS II Webmanager detects the connection of the BACS CSxxx current sensors and will automatically monitor and display the measuring value for each of the strings accordingly the position of the DIP SW. Please note, that it is required to enable the function « BACS CS Current Sensor connected » into the BACS Configuration menu.If you want to change the setting of the switch into operating mode, it is required to disconnect the power supply via detaching of the bus connection, so the new string number will be active. See the following table for switch settings and their string allocation:

S1 / 1:	S1 / 2:	S1 / 3:	S1 / 4:	String Number:
off	off	off	off	1
on	off	off	off	2
off	on	off	off	3
on	on	off	off	4
off	off	on	off	5
on	off	on	off	6
off	on	on	off	7
on	on	on	off	8
off	off	off	on	9
on	off	off	on	10

Status LED:
When green LED on the BACS_CSxxx Current Sensor is flashing it indicates that power is available. The green LED is constantly on if the device was detected by the BACS Webmanager and measuring values are transferred (normal operation). If the communication to the BACS Webmanager is interrupted, the LED will start flashing after 60 seconds to indicate that there is communication problem.

Diagram of BACS_CSxxx Current Sensor Type CS II (Build Year 2009):

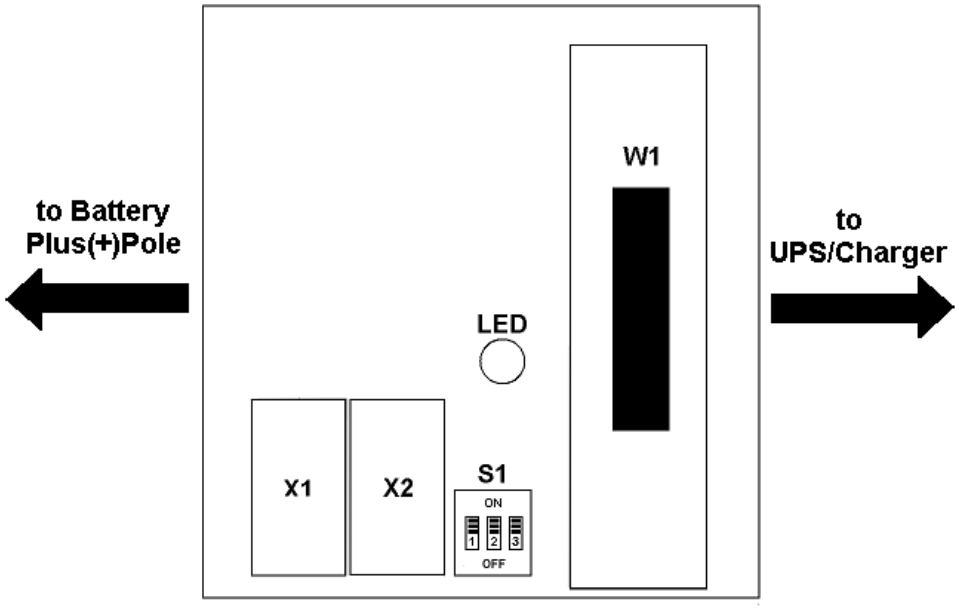

Figure 80: BACS_CSxxx Typ CS_II

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Diagram of BACS_CS III xxx Current Sensor Type CS III (Build Year 2010):

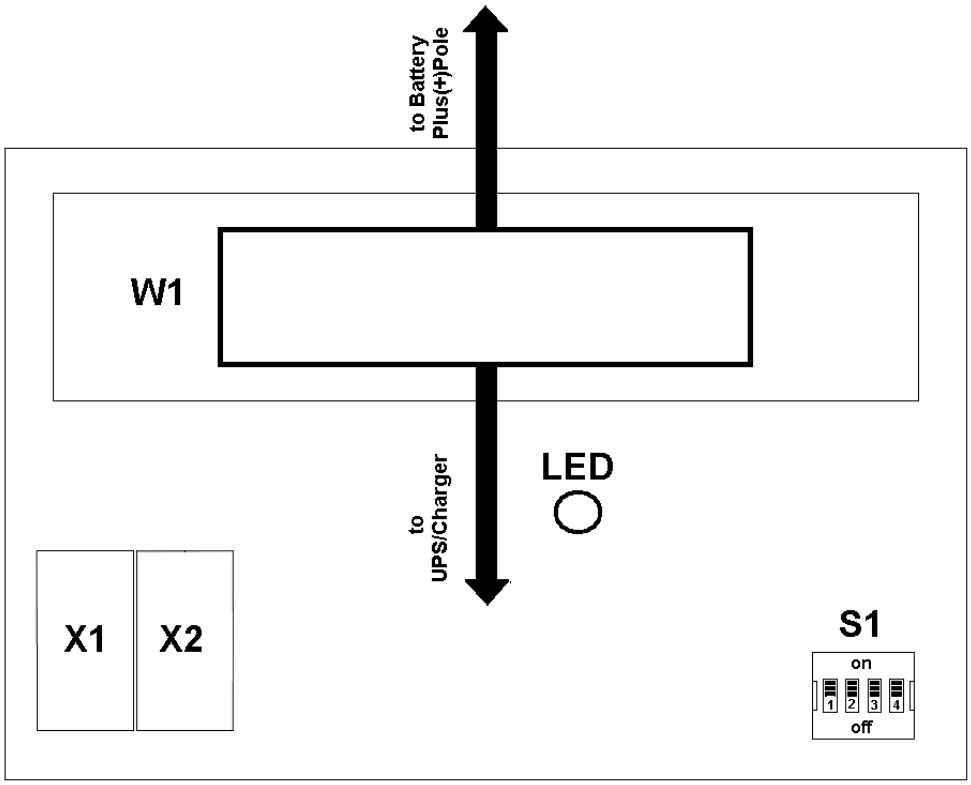

Figure 81: BACS_CSxxx Typ CS_III

Attention: If BACS_CSxxx Current Sensors will be refitted, please note, that the power supply of the BACS BUS CONVERTER or rather BACS WEBMANAGER BUDGET II is a controlled (stabilized) 12V power supply. The feeding has to be stable (+/- 0,5V) !

9.5 BACS® Control Cabinets Type 1 – 4

The BACS Control Cabinets are ready to install cabinets with up to 6 BACS WEBMANAGER and the accordant power supplies, so that only one power feed and one network cable is required. The cabinets simplify the assembling and provide through their integrated displays into the front door even into closed state a quick overview of the system.

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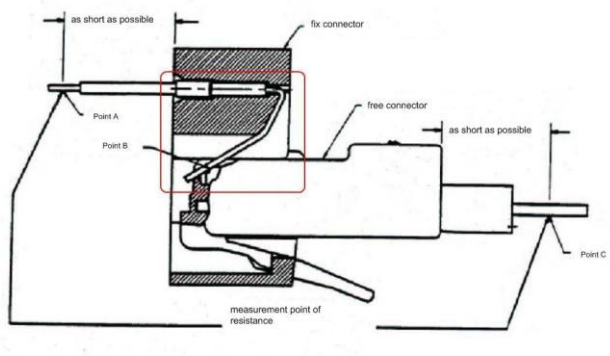
Figure 82: BACS Control Cabinet

10. BACS FAQ

In this chapter we describe well known problems you may encounter during installation or configuration of BACS. We regularly update this chapter as a feedback to solutions for well known problems.

Frequently Asked Questions

Problem: BACS modules are not able to address or rather not available.
Solution: If you get problems with the addressing of the modules, so the problem might be a not well-fitting B2BCRJxxx cable. Disconnect the B2BCRJxxx cable out of the module with the address **prior** of the incorrect one and check, if the 4 metal reeds are located at the same level into the body of the RJ10 connector. If not (e. g.: because of oblique connection of the cable), please correct it while pulling down the metal reeds until they are located at the same level and so the pressure at the BACS cable is equal. Furthermore you should change the B2BCRJxxx cable, because it might be incorrect too and thus the metal reeds are not located right. In case of doubt please change both, the module and the cable, because to limit the source of defect.



Problem: BACS modules are not able to address or rather not available.
Solution: The B2BCRJxxx cable is another source of defect. Please check optical, if the 4 wires are in sight at the plug. If not please change the cable, because an adjustment is not possible.

Problem: The battery will be discharged, if BACS is connected.

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Solution: If the **BACS modules** from **hardware revision 1.4** will not be polled from the BACS Webmanager for a longer time (between 9 to 16 hours), the BACS modules will switch into “Sleep Mode”, to reduce the power consumption (the remain consumption is 6-8mA per module). We refer, that a long off-time (more than 2 months) might be enough to discharge the accumulators. We recommend, at a longer off-time, to disconnect the modules from the batteries, until the accumulator will be able to reconnect to the charger. If BACS modules from hardware revision 1.4 and higher are in the “Sleep Mode”, they need up to 5 minutes to “awake”. That means the BACS Webmanager needs to send signals for a longer time to them, until the modules will be back in operation mode, displayed by their LEDs. The duration of the process depends of the amount of accumulators in the string (generally between 1 to 5 minutes). You can speed up the process, if you disconnect the BACS modules from the measuring cables for a short time and reconnect them. After that the BACS Webmanager will be back in operating mode.

BACS modules prior of hardware revision 1.4 possess no “Sleep Mode”, so that an inclusion is allowed with disconnected BACS modules only.

Problem: The BACS module displays less voltage clearly, than the truly value of the battery.
Solution: This suggests that a broken BACS measuring cable. Check the measuring cable on a second accumulator. If the failure is now not apparent anymore, then replace the BACS measuring cable.
Problem: The BACS modules are not able to address at the end of a string.
Solution: Take the modules at the beginning of the string or rather take the BACS Webmanager and the BACS Converter nearby of the appropriate modules to obviate to big cable lengths. If you are now able to address the modules, then the BACS bus cable is too long and a BACS Splitting Box should be inserted or it is required to optimize the cabling, to reduce the total length of the BACS bus cable.

Problem: Communication problems to the BACS modules.
Solution: It could be last 45 seconds per module, until the “BACS Communication Lost” alarm will be triggered.

Problem: BACS modules signal system- or false alarms.
Solution 1: You are using the wrong power supply or rather the power supply is without transformer. The power supply, which is a known problem: MW (Mean Well) GS18E15-P1J/ 13-16V / 1,38-1,12A
Solution 2: The power supply is too weak. The default scope of delivery is a 500mA power supply (for up to 100 BACS modules). From 120 modules you need an 800mA power supply, 1A up to 200 modules, 1,4A up to 256 modules. You need 5mA per BACS module.

Problem: All BACS modules head into addressing mode. You are able to get the first module via pressing of the addressing button from the addressing mode (red fast flashing) into normal condition (green constantly), but the address will not be assumed, the response into the web-browser of “refresh” will not be send and the modules remain on address 1.
Reason: At least one BACS bus-cable is damaged at PINs 3 and 4 (address return line).
Solution: Act step-by-step, at first exchange the BACS bus-cables from module 1 to 10 and re-address them. If okay, than the next 10 modules etc., until the fault will occur.

Problem: BACS shows red status LED communication lost. Why does it take so long before such an event is visible on the BACS screen?
Solution: If communication breakdowns to the BACS modules occur, it will last 45 seconds per module, until the „BACS Communication Lost“ warning will be displayed

Problem: BACS modules or sensors fall off; adhesive glue/bonding is not strong enough

Solution: This is a problem which is mostly caused by too much tension on the BACS module or Temperature sensor due to the BACS measuring cable or the position of the BACS module at the battery (mostly if BACS module or Temperature sensor is not mounted on top of battery). If you cannot release the tension on the cables or change the position of the BACS module so that gravity cannot detach the modules, than you have to use additionally a glue to fix the sensors on the battery.

For cleaning and scouring of the battery cabinet please use only solvents recommend by the battery manufacturer. If you cannot find any of such recommendations at your battery manufacturer, we recommend to use a solvent like the HOPPECKE product “Battery Clean“or similar.

To fix the BACS Modules and Temperature sensors with glue, we recommend using a high quality silicone rubber compound.

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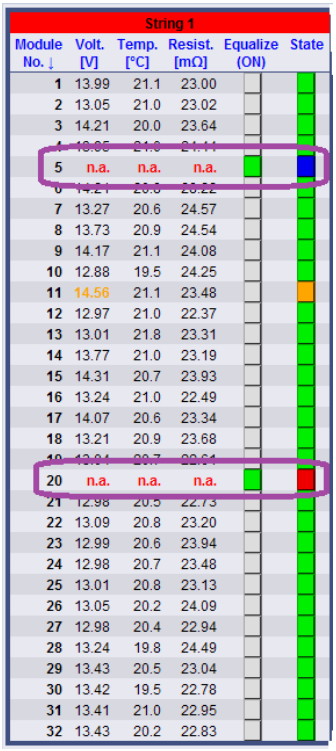
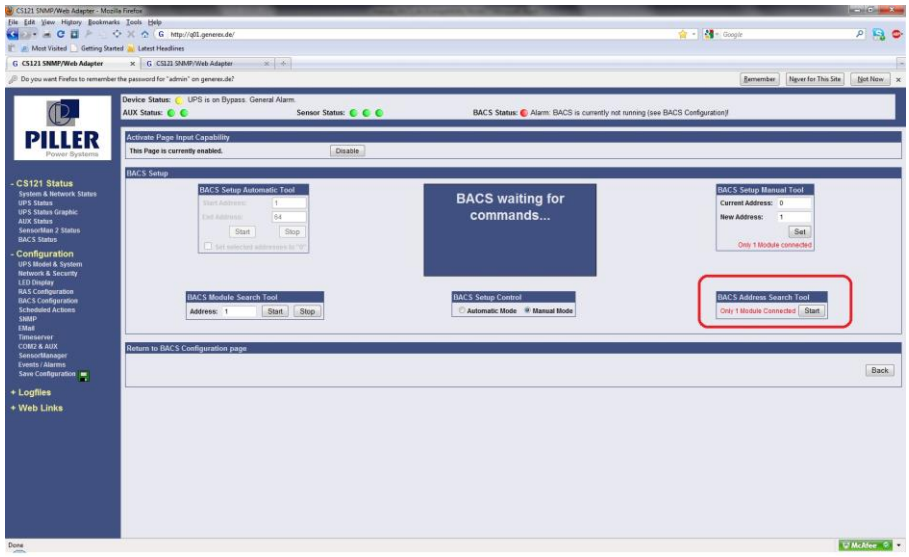
Problem: The BACS WEBMANAGER does not find all modules and starts extremely slow. After the start-up has finished, the BACS Status page shows at one (or more) modules a BLUE Status Icon and no measuring data, while on others it shows a RED Status Icon, also without measuring data (see Screenshot below, left):



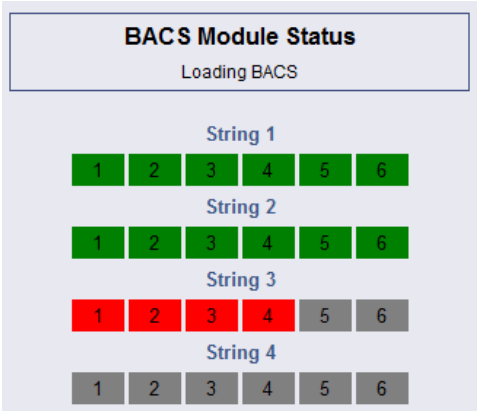
String 1

Module No. ↓	Volt. [V]	Temp. [°C]	Resist. [mΩ]	Equalize (ON)	State
1	13.99	21.1	23.00		
2	13.05	21.0	23.02		
3	14.21	20.0	23.64		
5	n.a.	n.a.	n.a.		
7	13.27	20.6	24.57		
8	13.73	20.9	24.54		
9	14.17	21.1	24.08		
10	12.88	19.5	24.25		
11	14.56	21.1	23.48		
12	12.97	21.0	22.37		
13	13.01	21.8	23.31		
14	13.77	21.0	23.19		
15	14.31	20.7	23.93		
16	13.24	21.0	22.49		
17	14.07	20.6	23.34		
18	13.21	20.9	23.68		
20	n.a.	n.a.	n.a.		
22	13.09	20.8	23.20		
23	12.99	20.6	23.94		
24	12.98	20.7	23.48		
25	13.01	20.8	23.13		
26	13.05	20.2	24.09		
27	12.98	20.4	22.94		
28	13.24	19.8	24.49		
29	13.43	20.5	23.04		
30	13.42	19.5	22.78		
31	13.41	21.0	22.95		
32	13.43	20.2	22.83		



Solution: This shows that there are at least 2 modules with a double address in the BACS Bus. In the screenshot above, the double address is at number 20. Disconnect all BACS modules from the BACS Bus and connect only the modules (one after the other), which are shown with a RED Status Icon. Check now with the BACS SETUP page, Manual Mode, function “BACS Address Search Tool” (marked red in the BACS CONFIGURATION screen above, right side), which address the connected module has. If the address is wrong (double), correct it with the function “BACS Setup Manual Tool” in the same BACS CONFIGURATION page.

Problem: After the reboot of the BACS WEBMANAGER, unreachable BACS C-Modules are displayed during initialization.



Solution: Check the wiring of the “Unreachable Modules” (like the above example 13 to 24).

Problem: The access to the BACS data with the BACS Viewer is not possible. An error occurs, that a password was not set and you can not click the password menu button.

Solution: This might be a problem with the Toshiba Password Manager. It is required, that this manager is disabled for the operation with the BACS Viewer.

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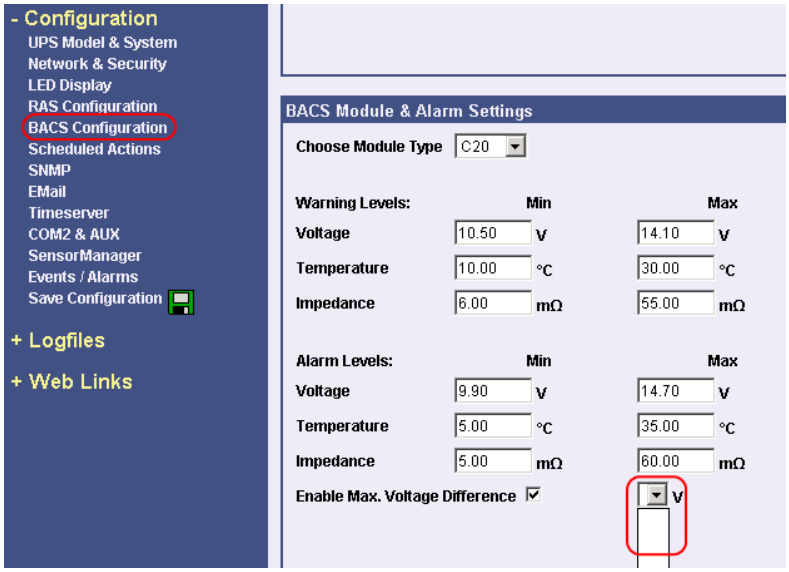
Problem : The BACS status displays a « Equalisation Error » for a BACS-C-Module.

Solution : This alarm occurs, if a BACS module delivers more Equalisation power than designated. This is a fault of the module. It is required to exchange this module, to avoid more damages.

Problem : You can not select a value for the voltage difference into the BACS Configuration menu « BACS Module & Alarm Settings ».



Solution : The web-browser versions Internet Explorer 8.0 and Mozilla Firefox 3.5 and higher are required.

Problem: Accumulator exchange at a BACS system

Solution: If accumulators are damaged and have to be exchanged and therefore older accumulators will remain into the system, please note, that the new accumulators should be implemented fully charged or a discharge on all accumulators has to be executed to start a boost charge on all accumulators. Reason : Accumulators, which are not fully charged, will be charged through the EQUALISATION extra, but this will be done with a few charging current only. This may result in a not optimal removal of sulfatings and a not fully charged battery. A discharge on asll accumulators will cause a strong charging phase afterwards so that Equalisation can perform better on this new accumulator. The new accumulator will reach a full charge shortly and will stay in this state through the EQUALISATION.

Problem: The BACS battery history will be overwritten at BACS Budget devices.

Solution: The memory is dynamic and its logging period depends on the amount of batteries and the amount of occuring alarms or rather dischargings. If more than 20MB or 365 days are reached, the old ata will be overwritten. Please save and delete the BACS log files regularly (see chapter 6.4).

Problem: Error code of the BACS C-Module from REV. 3, date of manufacture 10/2011: During insertion of a BACS C-Module no LED is shining (sleep mode). As recently as the BACS bus is active, the BACS C-Modules awake and display, depending on the address status, a slow red flashing LED or a green LED (static, if polling into the bus, flashing, if no polling into bus). If the BACS C-Modules get their first bus signal and awake during a new installation, it is required, that they all display a slow red flashing LED (address = 0). If a LED displays a static red LED, than an error occurred at the temperature sensor.

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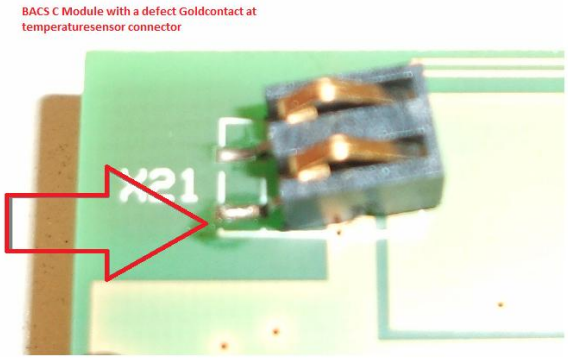
Solution: Open the module and check the temperature sensor into the housing (with measuring device, resistance between the poles should be 10kohm for the status OK, 0kohm is damaged).

Other error cause : Wrong assembling of the temperature sensor (see following figure) or contact problems with the main plate via gold contact.



Problem: The red LED at the BACS C-Module is shining steady.
Solution: That is an indication for a damaged temperature sensor or that the sensor got no contact to the board or the detector itself is damaged (normal operation of the LED, if okay and address « 0 » = red flashing).

Appendix

A. BACS buscabeling – technical description and examples

The BACS System use spezial buscables in different lengths (Product No. B2BCRJxxxx) to connect the BACS C-Modules together. To provide failure-free operation the buscables should be short as possible and not be install parallel to the powercables of the load. At battery systems with more than 70 batteries it's necessary to use a SPLITTINGBOX. With a SPLITTINGBOX it's possible to split the buscabeling radial with a certain number of modules. Detailed examples you'll find below in this description. The SPLITTINGBOX is optionally available and is not included in the shipment of the BACS WEBManager Starter Kits.

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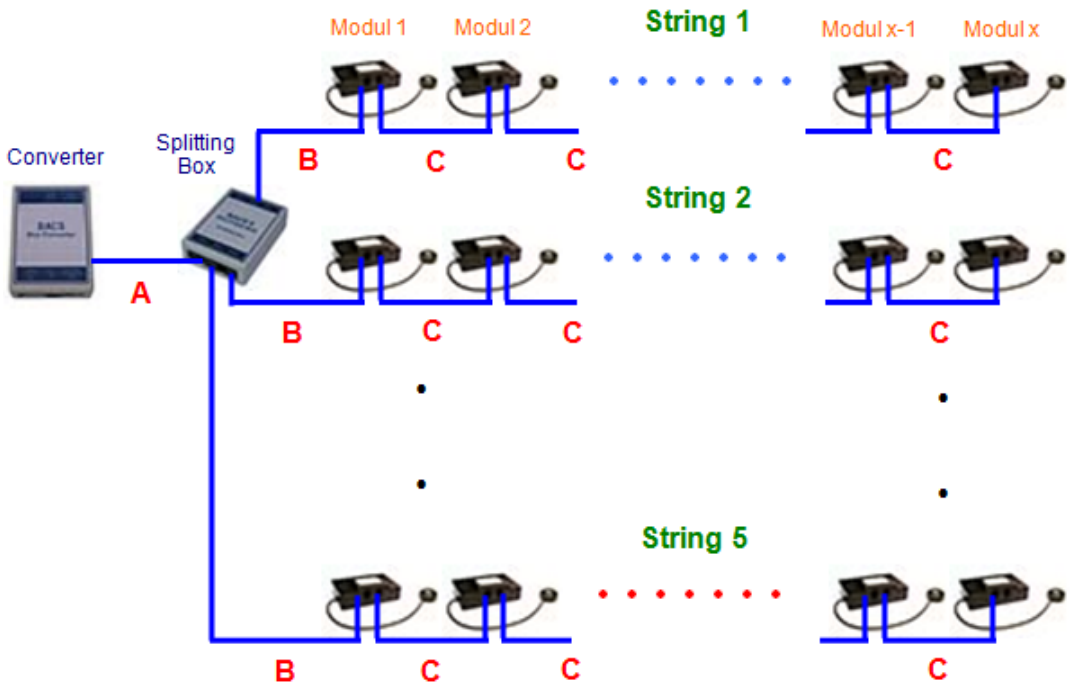

The picture above shows the maximum of 255 BACS modules for one BACSWEBMANAGER. The maximum number of modules per string depends on the sum of the buscable length between the modules (C), the length of the buscable from the SPLITTINGBOX to the first module (B) and from the BusConverter to the SPLITTINGBOX (A).
String means here **not** the batterystring but the busstring of the BACS modules. This means for example a batterystring with 136pcs. of 2V blocs will be seperate in more busstrings which will conected all to the SPLITTINGBOX. The maximum number of modules per busstring is declared with **(x)** and specified in the following table.
If there are existing fewer batteries than in picture above, only the number of busstrings will reduce, the number of the modules **(x)** per string will not change. At the total number of the modules less than **(x)** only one busstring will be build up and so the SPLITTINGBOX is not necessary.

The BACS buscables are available in lengths of 25cm, 40cm, 70cm, 1,5m, 3m, 5m and 10m. The lengths of 25cm and 40cm are designed for the connections between the modules and the higher lengths to connect the battery levels (70cm and 1,5m) together and also for the connection from the BUSCONVERTER to the SPLITTINGBOX or rather to the first module (1,5m, 3m, 5m and 10m).

Possibility configurations					
total quantity modules	length buscable C	length buscable A	length buscable B	min. quantity of busstrings	max. quantity of modules per string (x)
1 – 50	25cm	< 5m	1,5m	1²	50
1 – 50	25cm	10m	1,5m	1²	50
1 – 50	25cm	15m	1,5m	1²	50
1 – 50	40cm	< 5m	1,5m	1²	50
1 – 50	40cm	10m	1,5m	1²	50
1 – 50	40cm	15m	1,5m	1²	50
50 – 100	25cm	< 5m	1,5m	2²	50
50 – 100	25cm	10m	1,5m	2²	50
50 – 100	25cm	15m	1,5m	2²	50
50 – 100	40cm	< 5m	1,5m	2²	50
50 – 100	40cm	10m	1,5m	2²	50
50 – 100	40cm	15m	1,5m	2²	50
100 – 150	25cm	< 5m	1,5m	3²	50
100 – 150	25cm	10m	1,5m	3²	50
100 – 150	25cm	15m	1,5m	3²	50
100 – 150	40cm	< 5m	1,5m	3²	50
100 – 150	40cm	10m	1,5m	3²	50
100 – 150	40cm	15m	1,5m	3²	50
150 – 200	25cm	< 5m	1,5m	4²	50
150 – 200	25cm	10m	1,5m	4²	50
150 – 200	25cm	15m	1,5m	4²	50
150 – 200	40cm	< 5m	1,5m	4²	50
150 – 200	40cm	10m	1,5m	4²	50
150 – 200	40cm	15m	1,5m	4²	50
200 – 256	25cm	< 5m	1,5m	5²	51
200 – 256	40cm	< 5m	1,5m	5²	51

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[2] The quantity of strings could be increased if necessary but notice that the maximum quantity of modules per string will not be exceed. This could be accomplished by evenly distibuted modules to single busstrings from the SPLITTINGBOX. If you have more then 5 busstrings you have to use a second SPLITTINGBOX.

B. Hoppecke Monitoring Screws

Advice: HOPPECKE offer a monitoring screw set for their accumulators at the HOPPECKE order number: 7142000421. This set is designed for Voltage measuring only. To make this screw set also usable for BACS with Impedance measuring, you have to replace the original 8mm screw against a **10mm V2A screw** and washer to insure a firm connection to the HOPPECKE battery monitoring screw.

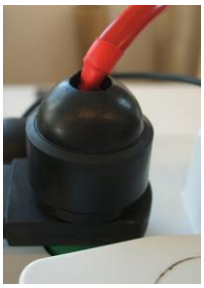
If you use the standard screw with 8mm there is the potential problem that the plastic coat gets softer over the years or through temperature change so that the screw is no longer tight. This will have an effect on the impedance measurement and may cause false alarms.

Please note for replacing the original HOPPECKE screw 8mm you may use our Product code “BACS_HOP” which consist of:

- BACS eyelet M5
- Spring washer (A5 V2A)
- M5 x 10mm hexagon pole screw (V2A)

Tightening torque: 5mm screws with 5 – 7 Nm

We recommend that any isolation plastic caps get changed for a proper cable installation.



In this example we recommend to arrange a hole from above.
The tension of the plastic cap should not be affected and the grip of the monitoring screws is ideal.

Quick Guide Cable Assembling at Rack Batteries
Stray the BACS measuring cable between the accumulators backwards. The BACS module should be mounted at the top of the accumulator (see fig. 60). The BACS measuring cable should be passed around the covering, so that no voltage leading pieces are able to jut out of the cap.

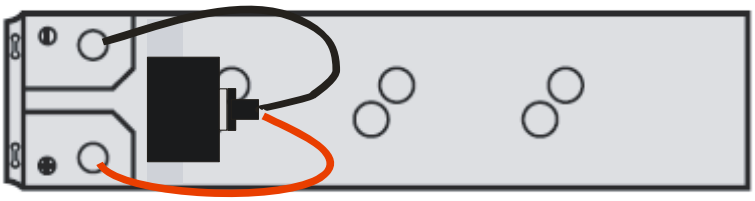


Figure 83: Cable Assembling at Rack Battery

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C. Installation Instruction external Temperature Sensor from BACS Rev. 3.x

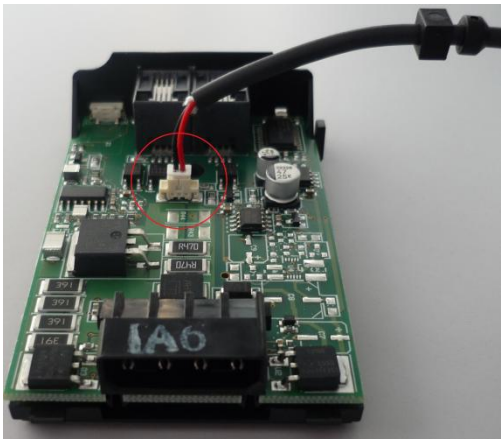
The BACS module from Rev.3.x up has a temperature sensor for detecting the battery temperature which is integrated on the bottom side of the housing. If the BACS module is mounted on the surface of the battery this temperature sensor is directly contacted to them.
If it's not possible to mount the BACS module Rev.3.x directly on the surface of the battery or you want to measure the temperature on another position you can use the optionally external BACS temperature sensor (BACS_TS). The external BACS temperature sensor (BACS_TS) is at the end of a 23cm long wire and will be connected to the already exiting pin on the BACS module Rev.3.x board.
To connect the external BACS temperature sensor (BACS_TS) please follow the instruction below:

- Disconnect all measuring -and bus cables from the BACS module

- Open the housing by levering the marks with a screwdriver carefully :

- Quarry out the rated break point carefully (forcipes, long-nosed pliers, etc.):

- Connect the plug of the temperature sensor to the pin on the BACS module Rev.3.x Board:



- Push the mains lead cleat in the side cutout of the housing:

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- Stick the upper -and under part of the housings together:

The external temperature sensor (BACS_TS) will be detected automatically at the next start of the BACS module and is active. The in the housing of the BACS module integrated temperature sensor will be deactivate automatically.

D. Storage of the BACS Webmanager Configuration

After you have finished your configuration, we recommend to store the configuration files. Via the “Save Configuration” menu and “Backup CS121 Configuration”, you can store the common UPS configuration file (upsman.cfg) and via “Backup BACS Configuration, you can store the BACS configuration file (bacs.ini).

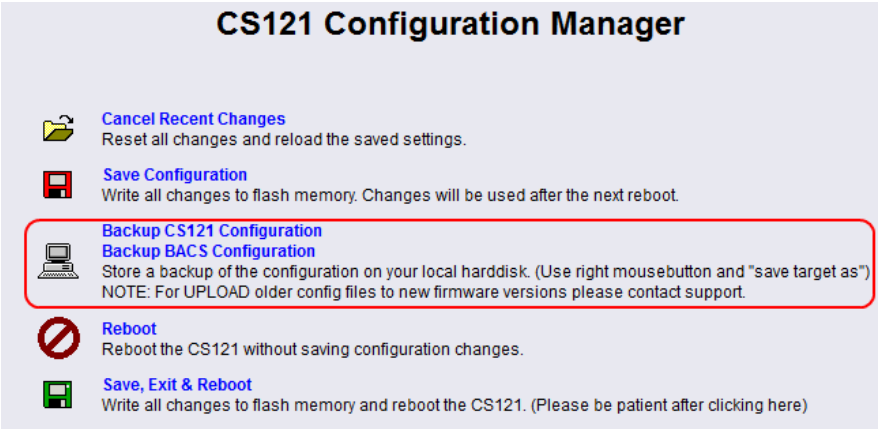
CS121 Configuration Manager
Cancel Recent Changes
Reset all changes and reload the saved settings.
Save Configuration
Write all changes to flash memory. Changes will be used after the next reboot.
Backup CS121 Configuration
Backup BACS Configuration
Store a backup of the configuration on your local harddisk. (Use right mousebutton and "save target as")
NOTE: For UPLOAD older config files to new firmware versions please contact support.
Reboot
Reboot the CS121 without saving configuration changes.
Save, Exit & Reboot
Write all changes to flash memory and reboot the CS121. (Please be patient after clicking here)

Figure 84: Backup Configuration

If you want to update the BACS Webmanager firmware version and it might not be able to keep your old configuration, you can transfer the stored files via FTP into the flash folder of the BACS Webmanager. Enter the following into a web-browser:

ftp://IP address of the BACS II Webmanager Budget/flash

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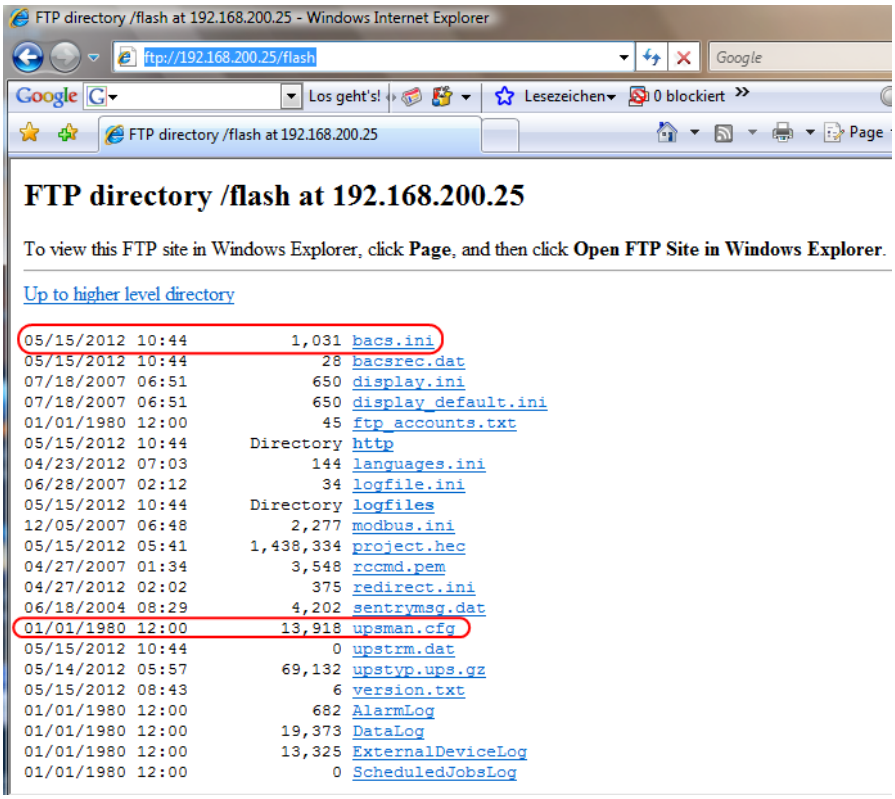
FTP directory /flash at 192.168.200.25 - Windows Internet Explorer
ftp://192.168.200.25/flash
FTP directory /flash at 192.168.200.25
To view this FTP site in Windows Explorer, click Page, and then click Open FTP Site in Windows Explorer.
Up to higher level directory
05/15/2012 10:44 1,031 bacs.ini
05/15/2012 10:44 28 bacsrec.dat
07/18/2007 06:51 650 display.ini
07/18/2007 06:51 650 display_default.ini
01/01/1980 12:00 45 ftp_accounts.txt
05/15/2012 10:44 Directory http
04/23/2012 07:03 144 languages.ini
06/28/2007 02:12 34 logfile.ini
05/15/2012 10:44 Directory logfiles
12/05/2007 06:48 2,277 modbus.ini
05/15/2012 05:41 1,438,334 project.hec
04/27/2007 01:34 3,548 rccmd.pem
04/27/2012 02:02 375 redirect.ini
06/18/2004 08:29 4,202 sentrymsg.dat
01/01/1980 12:00 13,918 upsman.cfg
05/15/2012 10:44 0 upstrm.dat
05/14/2012 05:57 69,132 upstyp.ups.gz
05/15/2012 08:43 6 version.txt
01/01/1980 12:00 682 AlarmLog
01/01/1980 12:00 19,373 DataLog
01/01/1980 12:00 13,325 ExternalDeviceLog
01/01/1980 12:00 0 ScheduledJobsLog

Figure 85: BACS Webmanager FTP-Connection

E. Updating of the BACS Firmware

You should check if there are any firmware updates for your BACS WEBMANAGER available on a regular basis. To find out your actual BACS firmware version see at “System & Network Status”.

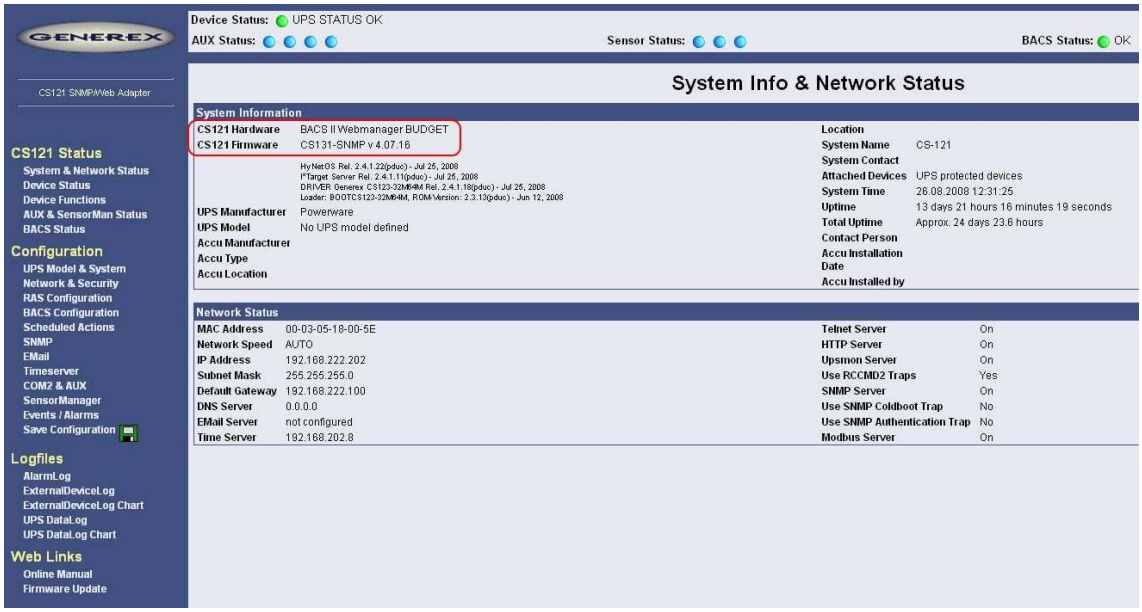

Figure 86: Web Interface System Information

Click the „Firmware Update“ button in the menu “Web Links” to check, if an update is available.

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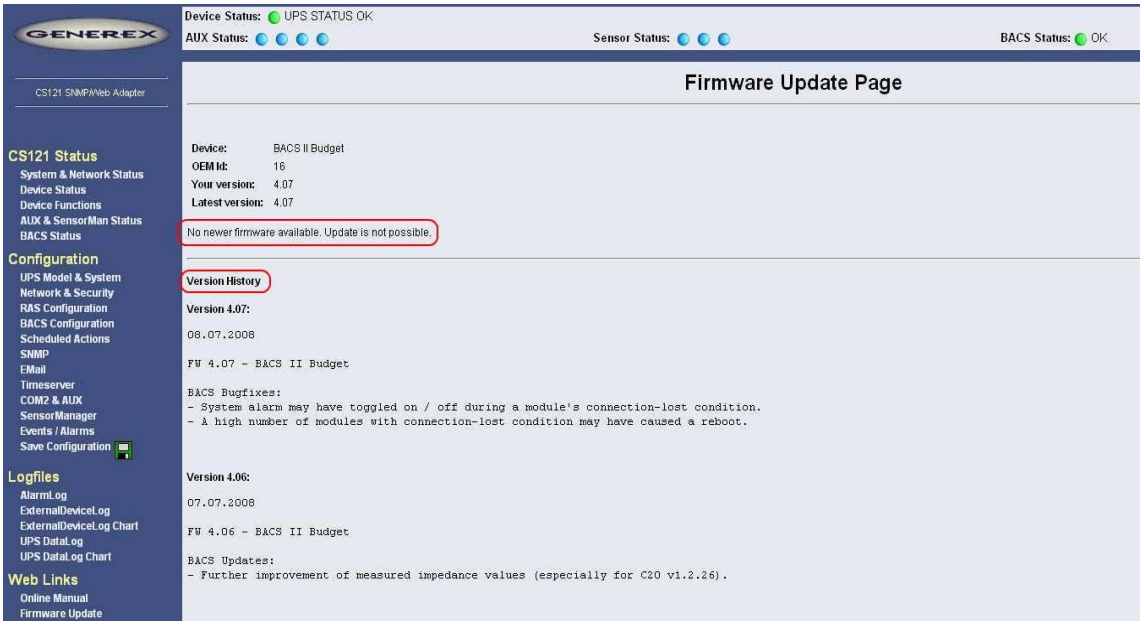

Figure 87: Web Interface Firmware Update Page

In the main frame appears the message “No newer firmware available…”, which means the BACS Webmanager Budget is up to date. You can see in the version history, what changes have conducted in the last update.

If you read a message in green letters like “Feature upgrade only”, than you may upgrade if any of the features look important for you, but you may also keep the system running on the actual firmware level. At any red message e.g. “Critical update” or similar text, please download and update your system as soon as possible.

Update is an easy, automated process which uses the local network to update your BACS WEBAMANGER. If you update any BACS Webmanager and BACS battery data is found, you receive a warning message and you may download and save these files during the update process.

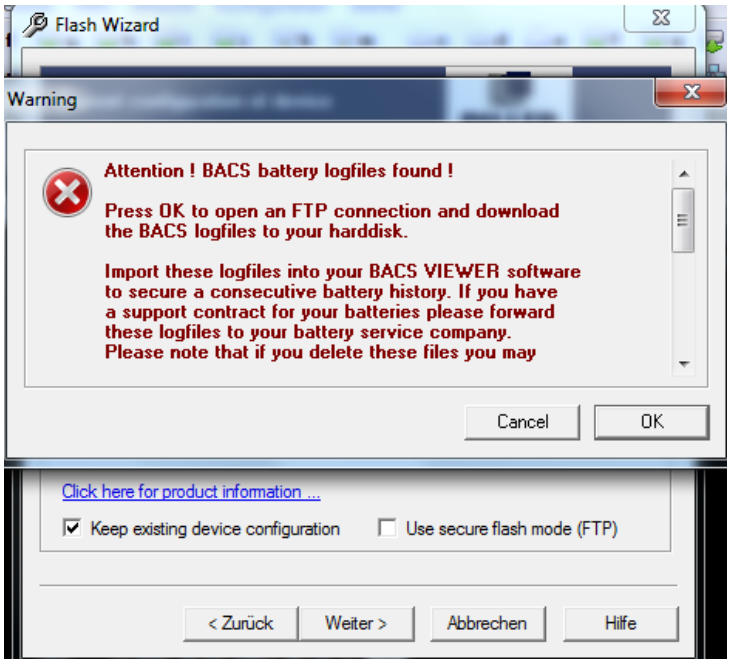
Flash Wizard
Warning
Attention ! BACS battery logfiles found !
Press OK to open an FTP connection and download the BACS logfiles to your harddisk.
Import these logfiles into your BACS VIEWER software to secure a consecutive battery history. If you have a support contract for your batteries please forward these logfiles to your battery service company.
Please note that if you delete these files you may
Cancel
OK
Click here for product information ...
Keep existing device configuration
Use secure flash mode (FTP)
< Zurück
Weiter >
Abbrechen
Hilfe

Figure 88: Firmware Update Warning

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If you have already downloaded these files recently, than you may ignore this message and click CANCEL to continue the update without saving BACS history files.

Advice: Please note, that you may lose the battery guarantee, if you delete these BACS files. Please check your warranty conditions for your batteries if such a BACS history is part of the warranty agreement. Besides downloading the BACS log files through the BACS VIEWER, you may also use any FTP client at port 21 (TCP) to download the files manually.

To import such manually downloaded files into your BACS VIEWER Software please check “Import BACS Data” in this manual.

F. Storage of Batteries with BACS

If you want to store batteries with BACS modules, please be aware that this increases the natural self-discharge of batteries. If BACS modules hardware revision 1.4 are polled from the BACS WEBMANAGER for a longer time (between 9 to 16 hours), these BACS modules will switch into a “Sleep Mode”, to reduce the power consumption (the remaining consumption in sleep mode is 6-8mA per module). Please note that at a long off-time (more than 2 months) even this small consumption might be enough to discharge the batteries. We recommend, at a long off-time, to disconnect the modules from the batteries, until the batteries will be able to reconnect to the charger. If BACS modules from hardware revision 1.4 and higher are in the “Sleep Mode”, they need up to 5 minutes to “wake up”. That means the BACS WEBMANAGER needs to send signals for a long time to them, until the modules will be back in operation mode, displayed by their LEDs. The duration of the process depends of the amount of accumulators in the string (generally between 1 to 5 minutes). You can speed up the process, if you disconnect the BACS modules from the measuring cables for a short time and reconnect them. After that the BACS WEBMANAGER will be back in operating mode.

BACS modules prior of hardware revision 1.4 do not have a “Sleep Mode”. These modules have to be removed from the power source to avoid deep discharges if the battery charger gets switched off.

If you want to store batteries or the battery charger is disconnected for a longer time, please note that you should also disconnect the BACS WEBMANAGER.

G. BACS Events/Alarms Description

Event	Description
BACS started	Battery monitoring started
BACS Discharging Phase	Battery discharging
BACS Charging Phase	Battery charging
BACS System Alarm	Module communication is lost and the system is in Alarm mode! React immediately!
BACS System Alarm off	Module communication restored
BACS Voltage High Alarm	BACS Voltage High Alarm
BACS Voltage High Alarm off	BACS Voltage High Alarm reset
BACS Voltage Low Alarm	BACS Voltage Low Alarm
BACS Voltage Low Alarm off	BACS Voltage Low Alarm reset
BACS Temperature High Alarm	BACS Temperature High Alarm
BACS Temperature High Alarm off	BACS Temperature High Alarm reset
BACS Temperature Low Alarm	BACS Temperature Low Alarm
BACS Temperature Low Alarm off	BACS Temperature Low Alarm reset
BACS Resistor High Alarm	BACS Resistor High Alarm
BACS Resistor High Alarm off	BACS Resistor High Alarm reset
BACS Resistor Low Alarm	BACS Resistor Low Alarm

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BACS Resistor Low Alarm off	BACS Resistor Low Alarm reset
BACS Voltage Diff High Alarm	Voltage difference between single batteries to high
BACS Voltage Diff High Alarm off	Voltage difference between single batteries okay
BACS Battery Breaker open Alarm	Battery breaker open, no battery protection active!
BACS Battery Breaker open Alarm off	Battery breaker closed
BACS Equalisation Error Alarm	Equalisation error
BACS Equalisation Error Alarm off	Equalisation error reset
BACS Voltage High Warning	BACS Voltage High Warning
BACS Voltage High Warning off	BACS Voltage High Warning reset
BACS Voltage Low Warning	BACS Voltage Low Warning
BACS Voltage Low Warning off	BACS Voltage Low Warning reset
BACS Temperature High Warning	BACS Temperature High Warning
BACS Temperature High Warning off	BACS Temperature High Warning reset
BACS Temperature Low Warning	BACS Temperature Low Warning
BACS Temperature Low Warning off	BACS Temperature Low Warning reset
BACS Resistor High Warning	BACS Resistor High Warning
BACS Resistor High Warning off	BACS Resistor High Warning reset
BACS Resistor Low Warning	BACS Resistor Low Warning
BACS Resistor Low Warning off	BACS Resistor Low Warning reset
BACS General Alarm	General failure/alarm, check website BACS for details
BACS General Alarm off	General failure/alarm reset

H. BACS II SNMP MIB Overview

Variable	OID
bacsSettings	1.3.6.1.2.1.33.5.1
bacsModuleTypes	1.3.6.1.2.1.33.5.1.1
bacsNumStrings	1.3.6.1.2.1.33.5.1.2
bacsNumBatteries	1.3.6.1.2.1.33.5.1.3
bacsBattCap	1.3.6.1.2.1.33.5.1.4
bacsLogRate1	1.3.6.1.2.1.33.5.1.5
bacsLogRate2	1.3.6.1.2.1.33.5.1.6
bacsResistPollRate	1.3.6.1.2.1.33.5.1.7
bacsBattAlarmLevel	1.3.6.1.2.1.33.5.1.8
bacsBattWarnLevel	1.3.6.1.2.1.33.5.1.9
bacsTemperatureLowAlarm	1.3.6.1.2.1.33.5.1.10
bacsTemperatureHighAlarm	1.3.6.1.2.1.33.5.1.11
bacsVoltageLowAlarm	1.3.6.1.2.1.33.5.1.12
bacsVoltageHighAlarm	1.3.6.1.2.1.33.5.1.13
bacsObjects	1.3.6.1.2.1.33.5.2
bacsStatus	1.3.6.1.2.1.33.5.2.1
bacsNumModules	1.3.6.1.2.1.33.5.2.4
bacsModuleTable	1.3.6.1.2.1.33.5.2.5
bacsModuleEntry	1.3.6.1.2.1.33.5.2.5.1
bacsModuleIndex	1.3.6.1.2.1.33.5.2.5.1.1
bacsModuleVoltage	1.3.6.1.2.1.33.5.2.5.1.2

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bacsModuleTemperature	1.3.6.1.2.1.33.5.2.5.1.3
bacsModuleBypass	1.3.6.1.2.1.33.5.2.5.1.4
bacsModuleResistance	1.3.6.1.2.1.33.5.2.5.1.5
bacsModuleState (see definition below)	1.3.6.1.2.1.33.5.2.5.1.6
bacsAlarms	1.3.6.1.2.1.33.5.3
bacsAlarmPresent	1.3.6.1.2.1.33.5.3.1
bacsAlarmTable	1.3.6.1.2.1.33.5.3.2
bacsAlarmEntry	1.3.6.1.2.1.33.5.3.2.1
bacsAlarmID	1.3.6.1.2.1.33.5.3.2.1.1
bacsAlarmDescr	1.3.6.1.2.1.33.5.3.2.1.2
bacsAlarmTime	1.3.6.1.2.1.33.5.3.2.1.3
bacsWellKnownAlarms	1.3.6.1.2.1.33.5.3.3
bacsAlarmSystemError	1.3.6.1.2.1.33.5.3.3.1
bacsAlarmResistWarn	1.3.6.1.2.1.33.5.3.3.2
bacsAlarmResistAlarm	1.3.6.1.2.1.33.5.3.3.3
bacsAlarmVoltage	1.3.6.1.2.1.33.5.3.3.4
bacsAlarmTemperature	1.3.6.1.2.1.33.5.3.3.5
bacsTraps	1.3.6.1.2.1.33.5.4
bacsTrapAlarmEntryAdded	1.3.6.1.2.1.33.5.4.1
bacsTrapAlarmEntryemoved	1.3.6.1.2.1.33.5.4.2

BACS Module State Definition:

Event	Dezimalwert
Ok	0
General Alarm	1
Communication Lost	2
Voltage High	4
Voltage Low	8
Temperature High	16
Temperature Low	32
Resistor High	64
Resistor Low	128
Equalisation Error (Modul EQ defekt)	256
Voltage Warn High	512
Voltage Warn Low	1024
Temperature Warn High	2048
Temperature Warn Low	4096
Resistor Warn High	8192
Resistor Warn Low	16384

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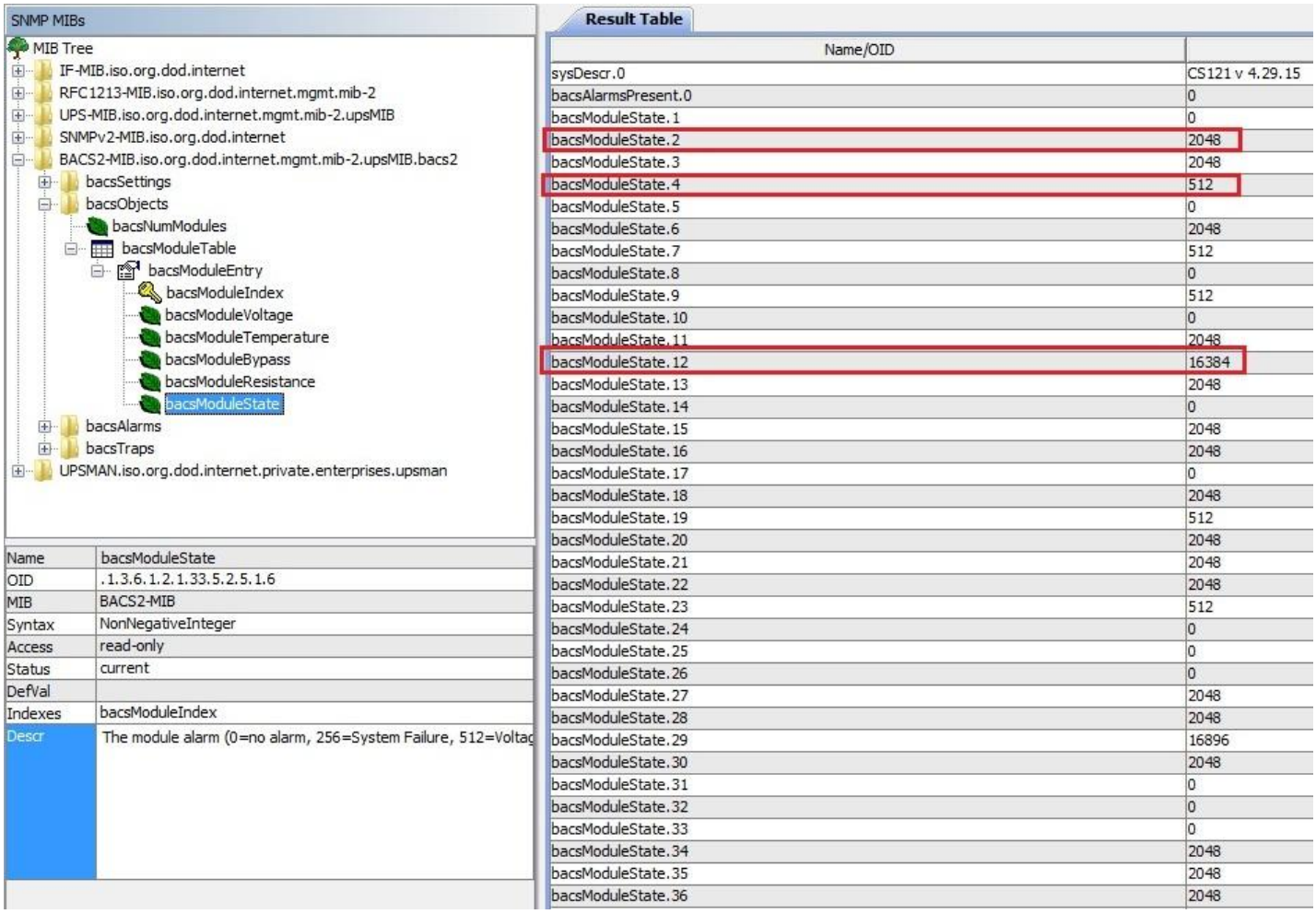

Figure 89: BACS SNMP Polling

BACS Status Definition:

Event	Dezimalwert
BACS_STATE_NONE	0
BACS_STATE_RUNNING	1
BACS_STATE_CONNECTED	2
BACS_STATE_MODULE_LOST	4
BACS_STATE_DISCHARGING	8
BACS_STATE_CHARGING	16
BACS_STATE_DISCHARGING_STOPPED	32
BACS_STATE_FLOAT_CHARGING	64
BACS_STATE_EQUALISATION	128
BACS_STATE_SYSTEM_FAILURE	256
BACS_STATE_VOLTAGE_OUTOFRANGE	512
BACS_STATE_TEMPERATURE_OUTOFRANGE	1024
BACS_STATE_RESISTOR-OUTOFRANGE	2048
BACS_STATE_MODULE-ADDRESSING	4096
BACS_STATE_MODULE-SEARCHING	8192
BACS_STATE_MODULE-INITIALIZING	16384

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BACS_STATE_MODULE-POLLING	32768
BACS_STATE_GENERAL_ALARM	65536
BACS_STATE_VOLTAGE_DIFF_HIGH	131072
BACS_STATE_BATTERY_BREAKER_OPEN	262144
BACS_STATE_THERMAL_RUNAWAY	524288
BACS_STATE_SENSOR_LOST	1048576

I. BACS MODBUS Parameter

Standard BACS – Address Description

Note: the max. number of BACS Modules requestable through MODBUS is 330.

Note: “Type U/S”: this defines whether the answer has an algebraic sign (math. +/-) or not. U means “unsigned”. S means “signed”, this answer may be positive or negative.

Address	Type	Function	Name	Description	Length
1000	U	3 / 4	<RESERVED>	Reserved, do not use ***4**	1
1001	U	3 / 4	<RESERVED>	Reserved, do not use ***5**	1
1000	U	3 / 4	BACS_ALARM_...	BACS Alarm Flags (see alarm flag definition below) ***6**	1
1003	U	3 / 4	<RESERVED>	Reserved, do not use	1
...	...	...	...	...	...
1010	S	3 / 4	STRING_01_CUR	String 1 current in Ampere [A]	1
1011	S	3 / 4	<RESERVED>	Reserved, do not use	1
...	...	...	...	...	...
1015	S	3 / 4	STRING_02_CUR	String 2 current in Ampere [A]	1
...	...	...	...	...	...
1055	S	3 / 4	STRING_10_CUR	String 10 current in Ampere [A]	1
...	...	...	...	...	...
1060	S	3 / 4	MODULE_001_ TEMP	Module 1 Temperature in Celsius [°C] (see Temfjasdfashfklashf) ***1**	1
1061	S	3 / 4	MODULE_001_ VOLT	Module 1 Voltage in Volt [V] ***2**	1
1062	S	3 / 4	MODULE_001_ IMPC	Module 1 Impedance in milliOhm [mΩ] ***3**	1
1063	U	3 / 4	MODULE_001_ ALARM	Module 1 Alarm flags _ ***6**	1
1064	S	3 / 4	MODULE_001_ EQ	Module 1 Equalizing in Percent [%]	1
1065	S	3 / 4	MODULE_002_ TEMP	Module 2 Temperature in Celsius [°C] ***1**	1
...	...	...	MODULE_x until No. 330.	...	...
2705	S	3 / 4	MODULE_330_ TEMP	Module 330 Temperature in Celsius [°C] ***1**	1
2706	S	3 / 4	MODULE_330_ VOLT	Module 330 Voltage in Volt [V] ***2**	1
2707	S	3 / 4	MODULE_330_ IMPC	Module 330 Impedance in milliOhm [mΩ] ***3**	1
2708	U	3 / 4	MODULE_330_ ALARM	Module 330 Alarm flags ***6**	1
2709	S	3 / 4	MODULE_330_ EQ	Module 330 Equalisation in Percent [%]	1

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Note: A value of -1 or -9999 means: This value is currently “Not available” (“N/A”).

***1 - Temperature value definition**:

Temperature T **in °C** $T = \frac{X-78}{2}$ **e.g.** $T = \frac{128-78}{2} = 25$

0xXX → 0 bis 255
0x7F 127 => 24,5°C
0x80 128 => 25°C
0x81 129 => 25,5°C

***2 - Voltage value definition**:

Voltage U **in V** Wert / 1000

e.g. **Voltage** U in **V** = 12825 / 1000 = 12,825 V

***3 - Impedance value definition**:

Impedance Z **in mΩ** Wert / 100

e.g. **Impedance** Z in **mΩ** = 4372 / 1000 = 43,72 **mΩ**

***4 – Address 1000 MODBUS/SNMP**	(hexadecimal)	(decimal)
BACS_STATE_NONE	0x0000	0
BACS_STATE_RUNNING	0x0001	1
BACS_STATE_CONNECTED	0x0002	2
BACS_ STATE_MODULE_LOST	0x0004	4
BACS_STATE_DISCHARGING	0x0008	8
BACS_STATE_CHARGING	0x0010	16
BACS_STATE_DISCHARGING_STOPPED	0x0020	32
BACS_STATE_FLOAT_CHARGING	0x0040	64
BACS_STATE_EQUALISATION	0x0080	128
BACS_STATE_SYSTEM_FAILURE	0x0100	256
BACS_STATE_VOLTAGE_OUTOFRANGE	0x0200	512
BACS_STATE_TEMPERATURE_OUTOFRANGE	0x0400	1024
BACS_STATE_RESISTOR-OUTOFRANGE	0x0800	2048
BACS_STATE_MODULE-ADDRESSING	0x1000	4096
BACS_STATE_MODULE-SEARCHING	0x2000	8192
BACS_STATE_MODULE-INITIALIZING	0x4000	16384
BACS_STATE_MODULE-POLLING	0x8000	32768

***5 – Address 1001 MODBUS/SNMP**	(hexadecimal)	(decimal)
BACS_STATE-GENERAL-ALARM	0x0001	1
BACS_STATE-VOLTAGE-DIFF-HIGH	0x0002	2
BACS_STATE-BATTERY-BREAKER-OPEN	0x0004	4
BACS_STATE_THERMAL_RUNAWAY	0x0008	8

***6 – Address 1002 Alarm Flags MODBUS/SNMP** (hexadecimal)		(decimal)
BACS_ALARM_NONE	0x0000	0

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BACS_ALARM_GENERAL_ALARM	0x0001	1
BACS_ALARM_COMMUNICATION_LOST	0x0002	2
BACS_ALARM_VOLTAGE_HIGH	0x0004	4
BACS_ALARM_VOLTAGE_LOW	0x0008	8
BACS_ALARM_TEMPERATURE_HIGH	0x0010	16
BACS_ALARM_TEMPERATURE_LOW	0x0020	32
BACS_ALARM_RESISTOR_HIGH	0x0040	64
BACS_ALARM_RESISTOR_LOW	0x0080	128
BACS_ALARM_EQUALISATION_ERR	0x0100	256
BACS_ALARM_VOLTAGE_WARN_HIGH	0x0200	512
BACS_ALARM_VOLTAGE_WARN_LOW	0x0400	1024
BACS_ALARM_TEMPERATURE_WARN_HIGH	0x0800	2048
BACS_ALARM_TEMPERATURE_WARN_LOW	0x1000	4096
BACS_ALARM_RESISTOR_WARN_HIGH	0x2000	8192
BACS_ALARM_RESISTOR_WARN_LOW	0x4000	16384
BACS_ALARM_MODREV_INCOMPATIBLE	0x8000	32768

J. BACS Maintenance

Generally the BACS Webmanager firmware should be updated in regular terms. Check the "firmware update link" for new versions.

Critical updates are shown in red, feature updates are shown in green. The BACS measuring cables and BACS bus communication cables require no maintenance. In case a fuse is blown in the BACS measuring cables, the complete cable has to be replaced. The BACS C modules itself should be kept clean and dry. In dusty or humid environments the BACS cabinets and the PCB inside should be cleaned in regular terms with compress air.

Blow compressed air through the ventilation holes from both sides for some seconds to remove infiltrated dust or dirt through the opposite ventilation holes.

Figure 90: BACS C Module Top View

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After several years operation in dusty/dirty environments the temperature sensor board may lose contact. To remove this problem disconnect the BACS C sensor from the measuring cable and open the BACS cabinet. Remove the BACS main board and clean the contacts between temperature sensor board and main board. Clean the dust box underneath the main board and re-assemble the cleaned C module.

Figure 91: BACS C Module Main Board and Dust Box

K. CS121/BACS WDP – Watchdog & Powermanager

The CS121 WDP is an optional Watchdog & Powermanager piggyback board for the CS121/BACS series. It is a separate chipset, which can be attached to a CS121/BASC and it works as a Hardware watchdog to reset (cold boot) the processor, if a heartbeat signal is not received in an interval of 60 seconds.

Watchdog function: The watchdog starts 5 minutes after the CS121 has rebooted. If then the Watchdog does not receive within 120 seconds no alive signal from the processor, it will disconnect the power supply for a reset.

Powermanager function: Additionally this device checks the input power supply and blocks the startup of the processor until the power supply is stabilized and has reached at least a level of 8 Volt. This avoids startup problems at non stabilized power supplies or other power supply problems in UPS slots.

This product is designed to work as add-on for all CS121 based products with an internal connector such as all BACS WEBMANAGER BUDGET, CS121 SC,L,SCM,LM and the CS121 BUDGET series with 16MB flash ROM built after 2010.

Installation: To mount the CS121WDP Piggy Board on the CS121 Board, be sure, that the power supply is disconnected. Plug the CS121WDP Board on the CS121-Board like in the below pictures. The Piggy Board runs without any configuration and starts his functions immediately after connection. For using the Watchdog functionality, a firmware release after FW 4.28 is required. The Powermanager function is not depending on any FW level.

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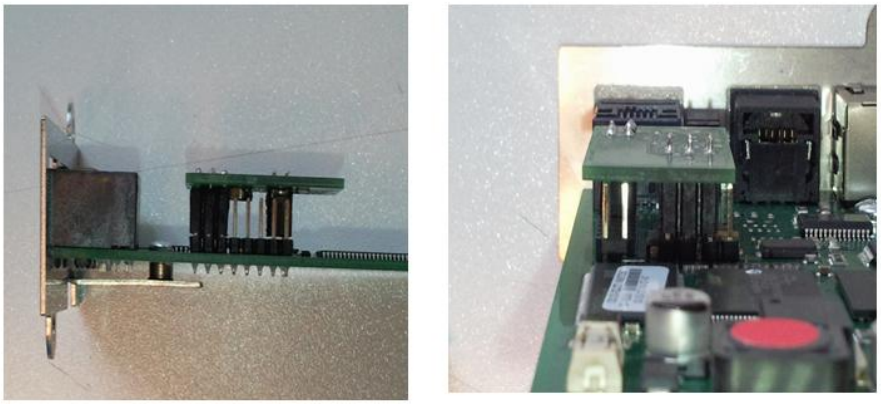

Figure 92: CS121/BACS WDP installed on a CS121/BACS board – view from left and behind

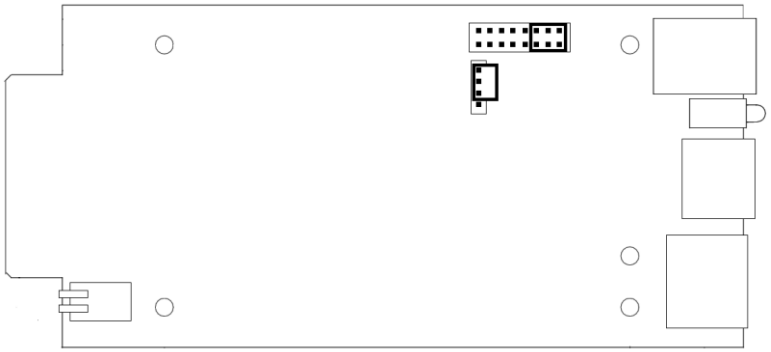

Figure 93: CS121/BACS WDP connecting PINs on a CS121/BACS board – top view

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